Course Number : CO542
Course Title : Neural Networks and Fuzzy Systems
Credits : 3
Core/Elective : Technical Elective
Prerequisites : None

Aims/Objectives:

- The aim of this course is to impart a working knowledge of the theory and practice of Artificial Neural Networks and Fuzzy Systems and enable students to use them in designing intelligent systems. The students will learn how to build prototype intelligent systems/solutions in product design, commercial/trade and scientific applications.

Intended Learning Outcomes (ILOs)

Upon completion of the course, students should be able to:

1. Apply theories and techniques of Artificial Neural Networks and Fuzzy Systems to identify potential applications in real-life product design, commercial/trade and scientific problems.
2. Analyse and formulate the problem for solution using Artificial Neural Networks and Fuzzy Systems.
3. Develop prototype solutions to the formulated problem and validate them.
4. Continue developing their Artificial Neural Networks and Fuzzy Systems skills by keeping abreast with new learning in the area through continuous learning.

Textbooks and References:

1. Neural Networks – A comprehensive Foundation, Simon Haykin, MacMillan Publishing Company (1994).
2. Fundamentals of Artificial Neural Networks, Mohamad Hassoun, MIT Press 1996.
3. Fuzzy Logic with Engineering Applications, T. J. Ross, 3rd Edition, Wiley 2010.

Topic	Time Allocated / hours			
	L	T	P	A
Introduction to **Artificial Neural Networks (ANN):** Concepts, basic model of a neuron	2			
Learning in ANN: Supervised learning, unsupervised learning, reinforced learning, competitive learning, the delta rule, Hebbian learning, ANN adaptability.	3			

The Perceptron: Neural networks paradigms, perceptron, Adaline and Madaline models	2		3	
Back Propagation Algorithm: Learning with the back propagation, mathematical analysis, applications.	3		3	
Hopfield Model: Mathematical analysis, Hopefield learning algorithm, applications**.**	2		3	
Memory Type Paradigms: Bidirectional associative memory, temporal associative memory, linear associative memory, self-organizing maps.	3			
Introduction to Fuzzy Systems: Fuzzy sets, membership functions, Fuzzy set operations, properties of fuzzy sets.	1			
Fuzzy Relations: Membership functions, Fuzzy relations, fuzzyfications, operations on fuzzy relations.	2		2	
Extension Principle: Fuzzy to crisp conversions, extension principle, fuzzy numbers, fuzzy vectors.	2		2	
Fuzzy Inference: Fuzzy reasoning, fuzzy inference, fuzzy rule based systems, design of rule based systems.	3		3	
Fuzzy Non-linear Simulation: Fuzzy non-linear simulation, fuzzy decision making, cluster analysis, fuzzy c-means.	3		2	
Fuzzy Applications: Fuzzy pattern recognition, fuzzy control systems.	4		2	
Fuzzy Neural Networks Applications	3		2	2
Total	33		22	2

L = Lectures, T = Tutorial classes, P = Practical classes, A – Homework assignments

Assessment	Percentage Marks
Continuous Assessments	50
Practical	20
Assignments	10
Mid Semester Examination	20
End of Semester Evaluation	
End-Semester Examination	50
	50