

Soft Computing	3	1	0	Probability and statistics, Machine learning
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Course Objective: 1. To design fuzzy systems for real-world problems using fuzzy logic and fuzzy sets.
2. To design and describe the architecture and functioning of neural networks and neuro-fuzzy systems.
3. To describe various evolutionary algorithms with application to real-world optimization problems.

S. NO.	Course Outcomes (CO)
CO1	Ability to distinguish between supervised, unsupervised and reinforcement learning.
CO2	Ability to construct a neural network architecture and describe its functioning mathematically.
CO3	Ability to execute operations with fuzzy sets and construct fuzzy rules.
CO4	Ability to solve simple problems involving fuzzy arithmetic and fuzzy numbers.
CO5	Ability to explain and compare different evolutionary algorithms.
CO6	Ability to construct the architecture and describe the functioning of neuro-fuzzy systems for simple application problems.

S. NO.	Contents	Contact Hours
UNIT 1	Neural Networks: Introduction to Learning Paradigms-Supervised, Unsupervised and reinforcement Learning. History of neural networks, overview of biological Neuro-systems, Mathematical Models of Neurons, ANN architecture and training algorithms- Perceptron, Multi-Layer Perceptron Model, Back Propagation algorithm, Applications of Artificial Neural	12
UNIT 2	Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.	6
UNIT 3	Operations on Fuzzy Sets: Complement, Intersections, Unions, Combinations of Operations, Aggregation Operations. Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	8
UNIT 4	Evolutionary Optimization: Introduction to evolutionary optimization algorithms - Genetic Algorithm, Particle Swarm Optimization, Grey Wolf Optimization, Artificial bee colony algorithm. Comparison to classical optimization using gradient descent and Meta-heuristic optimization algorithm - Simulated annealing.	10
UNIT 5	Neuro-Fuzzy Systems: Adaptive neuro-fuzzy inference systems - ANFIS, CANFIS, MANFIS. Architecture and learning process, Examples of application to real-world problems.	6

	TOTAL	42
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