Course code: Course Title	Course Structure			Pre-Requisite
SE321: Soft Computing	**L**	**T**	**P**	**Discrete Mathematics**
	3	**1**	**0**	

Course Objective: The course integrates the concepts of fuzzy logic, neural networks, and optimization techniques for understanding the complex nature of decisions taken by human beings which incorporates partial understanding of the truth with past experience. At the end of this course the student should be able to understand the basic techniques used in soft computing and apply them to solve real world problems.

S. NO	Course Outcomes (CO)
CO1	Understand the basic concepts of artificial neural networks and apply artificial neural network models and learning algorithms.
CO2	Analyze fuzzy logic principles and creation of fuzzy rules, and also evaluates membership function to solve problems.
CO3	Understand and evaluate various operations on fuzzy sets such as compliment, intersections, unions, and aggregation.
CO4	Apply and analyze evolutionary computing algorithms.
CO5	Analyze the architecture and evaluate the functioning of neuro-fuzzy systems.

S. NO	Contents	Contact Hours
UNIT 1	**Neural Networks:** History, Overview of Biological Neuro-System, Mathematical Models of Neurons, ANN Architecture, Learning Rules, Learning Paradigms-Supervised, Unsupervised and Reinforcement Learning, ANN Training Algorithms-Perceptrons, Training Rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	8
UNIT 2	**Fuzzy Logic:** Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.	7
UNIT 3	**Operations on Fuzzy Sets:** Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations. Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets	6
UNIT 4	**Fuzzy Arithmetic:** Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	6
UNIT 5	**Evolutionary Computing:** Introduction, Evolutionary Techniques, Swarm Intelligence, Bacterial Foraging, Ant Colony Optimization, and Genetic Algorithm.	8
UNIT 6	**Introduction of Neuro-Fuzzy Systems:** Architecture of Neuro Fuzzy Networks.	7
	TOTAL	42

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	J. A. Anderson, "An Introduction to Neural Networks", PHI.	1995
2	John A. Hertz, Anders S. Krogh, Richard G. Palmer, "Introduction to the Theory of Neural Computation", CRC Press, 1st Edition.	1991

3	George J. Klir and B. Yuan, "Fuzzy Sets & Fuzzy Logic – Theory and Applications", Pearson, 2nd Edition.	**2015**
4	Melanie Mitchell, "An Introduction to Genetic Algorithms", PHI, 1st Edition.	**1998**
5	S V Kartalopoulos, "Understanding Neural Networks and Fuzzy Logic – Basic Concepts and Applications", IEEE Press, PHI, 1st Edition.	**1995**
6	S. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Application", PHI, 1st Edition.	**2003**