

## **Soft Computing**

**CS703B**

**Contracts: 3L**

**Credits- 3**

### **Module-I [2L]**

*Introduction:* Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.

### **Module-II [10L]**

*Fuzzy sets and Fuzzy logic systems:*

**Classical Sets and Fuzzy Sets and Fuzzy relations :** Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.

**Membership functions :** Features of membership functions, standard forms and boundaries, different fuzzification methods.

**Fuzzy to Crisp conversions:** Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.

**Classical Logic and Fuzzy Logic:** Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication

**Fuzzy Rule based Systems:** Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models.

**Applications of Fuzzy Logic:** How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting

### **Module-III [10L]**

*Neural Network*

**Introduction to Neural Networks:** Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.

**Learning Methods :** Hebbian, competitive, Boltzman etc.,

**Neural Network models:** Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks.

**Competitive learning networks:** Kohonen self organizing networks, Hebbian learning; Hopfield Networks.

**Neuro-Fuzzy modelling:**

**Applications of Neural Networks:** Pattern Recognition and classification

### **Module-IV[10L]**

**Genetic Algorithms:** Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA).

**Applications of Genetic Algorithm:** genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition

### **Module-V [4L]**

Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

### **Text Books:**

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach, 1/e by Kumar Satish, TMH,
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson

### **Reference Books:**

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
2. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.