

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

## **MASTER OF COMPUTER APPLICATIONS (MCA)**

### **Semester: IV**

**Subject Name: Elective I – Soft Computing (SC)**

**Subject Code: 2640009**

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#### **Learning Objectives:**

- ✓ To emphasize on learning the design, implementation and application of soft computing methodologies.
- ✓ To give a detailed understanding of how to obtain the solution of cross-disciplinary problems quickly, accurately and acceptably.
- ✓ To discuss and understand the capability of neural networks, fuzzy systems and genetic algorithms to acquire and apply knowledge in an intelligent manner.

**Prerequisites:** Knowledge of Set Theory and Artificial Intelligence is desirable.

#### **Contents:**

- 1. Introduction (3 Lect.)**  
Neural Networks, Application Scope of Neural Network, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing
- 2. Artificial Neural Network : An Introduction (5 Lect.)**  
Fundamental Concept, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, McCulloch-Pitts Neuron, Linear Separability, Hebb Network
- 3. Supervised Learning Network (4 Lect.)**  
Introduction, Perception Networks, Back-Propagation Network, Radial Basis Function Network, Time Delay Neural Network
- 4. Associative Memory Networks (5 Lect.)**  
Introduction, Training Algorithm of Pattern Association, Autoassociative Memory Network, Heteroassociative Memory Network, Bidirectional Associative Memory, Hopfield Networks (Discrete Only)
- 5. Unsupervised Learning Networks (4 Lect.)**  
Introduction, Fixed Weight Competitive Nets, Kohonen Self-Organizing Motor Maps, Adaptive Resonance Theory Network
- 6. Special Networks (4 Lect.)**  
Introduction, Simulated Annealing Network, Boltzmann Machine
- 7. Fuzzy Set Theory (4 Lect.)**  
Fuzzy versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations

**8. Fuzzy Systems****(5 Lect.)**

Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule Based System, Defuzzification Methods, Applications

**9. Fuzzy Logic Control Systems****(4 Lect.)**

Introduction, Control System Design, Architecture and Operation of FLC System, FLC system models, Applications of FLC systems

**10. Fundamentals of Genetic Algorithms****(6 Lect.)**

Genetic Algorithms: History, Basic Concepts, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction.

**11. Genetic Modeling****(6 Lect.)**

Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators.

**Text Book(s):**

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India (P) Ltd.
2. S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms (Synthesis and Applications)", PHI Education.

**Suggested Additional Reading Book(s):**

1. S.N. Sivanandam and M. Paulraj, "Introduction to Artificial Neural Networks", Vikas Publishing House.
2. Fakhreddine O. Karray and Clarence De Silva, "Soft Computing and Intelligent Systems Design (Theory, Tools and Applications)", Pearson education.
3. D.K. Pratihari, "Soft Computing", Narosa Publishing House.
4. Sudarshan K. Valluru and T. Nageswara Rao, "Introduction To Neural Networks, Fuzzy Logic and Genetic Algorithms, JAICO Publishing House.
5. Pinaki Mazumder and Elizabeth M. Rudnick, "Genetic Algorithms for VLSI Design, Layout & Test Automation", Addison Wesley Ltd.

**Chapter wise Coverage from the Text Book(s):**

Book #	Chapters
1	1, 2, 3 (3.1, 3.2, 3.5–3.7), 4 (4.1–4.6 (4.6.1)), 5 (5.1–5.3,5.6), 6 (6.1–6.3), 14
2	6, 7, 8, 9 (9.1 – 9.5)

**Accomplishments of the student after completing the course:**

At the end of the work student will be able to

1. Get the knowledge of Soft Computing as Networks, Fuzzy Logic and Genetic Algorithms and its Hybrid Applications.
2. Apply hybrid nature of Soft Computing techniques to real world problems by extending the capabilities of existing technologies in more effective and efficient manner.