# SOFT COMPUTING TECHNIQUES

**Course Code:** 15EE2217

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Pre requisites:** Basic Knowledge of Optimization.

**Course Outcomes:** At the end of the course, the student will be able to

**CO1:** Explain the fundamentals & different types of Artificial Neural Networks (ANNs) and their applications

**CO2:** Defend Associate Memory Networks, SOM and ART

**CO3:** Explain the fundamentals & procedure of Fuzzy Logic (FL) Technique and its applications

**CO4:** Infer the basic concepts, procedure and applications of Genetic Algorithm (GA)

**CO5:** Apply the basic concepts, procedure and applications of Particle Swarm Optimization (PSO) Technique in solving problems.

**UNIT-I** (10-Lectures)

**ARTIFICIAL NEURAL NETWORKS (ANN) - I:**

(Fundamentals, Feed forward/Feedback Networks) Introduction, ANN Basic Building Blocks and Terminologies, ANN Models, Learning Rules, Perceptron Networks (Single layer / Multi layer), Feed Forward Networks- Back Propagation Networks (BPN), Feedback Networks - Hopfield Net, Applications of ANN.

**UNIT-II** (10-Lectures)

**ARTIFICIAL NEURAL NETWORKS (ANN) - II:**

(Associative Memory Networks, SOM and ART) Associative Memory Networks – Algorithms for pattern association, Hetero Associative Memory Neural Networks, Auto Associative Memory Networks, Bidirectional Associative Memory (BAM) Network, Relation between BAM and Hopfield Nets. Self-Organizing Feature Maps (SOM) – Kohonen SOM, Learning Vector Quantization (LVQ). Adaptive Resonance Theory (ART) – Fundamentals, ART1, ART2.

**UNIT-III** (10-Lectures)

**FUZZY LOGIC:**

Fuzzy Set Theory- Fuzzy versus Crisp, Crisp Sets, Fuzzy Sets – Membership Function, Crisp Relations, Fuzzy Relations, Fuzzy Systems-Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Ruled Based System, Defuzzification Methods.

**UNIT-IV** (10-Lectures)

**GENETIC ALGORITHMS (GA):**

GA Fundamentals Basic concepts, Creation of Offspring's, Working Principle, Encoding, Fitness Function, Reproduction, Genetic Modeling – Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operators, Bit-wise Operators used in GA, Generational Cycle, Convergence of GA, Applications, Multi-level Optimization, Differences and Similarities between GA and other traditional methods, Advances in GA

**UNIT-V** (10-Lectures)

**PARTICLE SWARM OPTIMIZATION (PSO):**

Basic concepts, Swarm intelligence, population, velocity updation, particle- best (pbest), global-best (gbest), velocity initialization, solution, Applications of PSO.

**TEXT BOOKS:**

1. S. N. Sivanandam, S. Sumathi, S. N. Deepa, "Introduction to Neural Networks using MATLAB 6.0", TMH, 2006 (Unit-I,II)
2. S. Rajasekharan and G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic, Genetic Algorithms - Synthesis and Applications", First Edition ,PHI Publication,2012(Unit III,IV)
3. Clerc, M. "Particle Swarm Optimization". First Edition, Wiley-ISTE, 2006 (Unit-V)

**REFERENCE BOOKS:**

1. J. S. R. Jang, C.T. Sun and E. Mizutani, "Neuro-Fuzzy and Soft Computing", Pearson Education 2004.

2. N. Yadaiah and S. Bapi Raju, "Neural and Fuzzy Systems": Foundation, Architectures and Applications, Pearson Education, 2010.
3. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2009.
4. Jacek M. Zurada, "Introduction to Artificial Neural Systems", 1st Edition, Jaico Publishing House, 2007.
5. F. Karray and C. De Silva, "Soft Computing and Intelligent Systems Design, Theory, Tools and Applications", Prentice Hall, 2004.