SUBJECT: SOFT COMPUTING TECHNIQUES

Learning Objectives:

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

Learning Outcomes:

Upon completion of this course, the students should be able to

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

UNIT I: INTRODUCTION TO SOFT COMPUTING :

Introduction of soft computing, soft computing vs. hard computing- various types of soft computing techniques- Requirements of Soft computing - applications of soft computing.

UNIT II: FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS:

Introduction to Artificial neural network: characteristics- Model of Artificial Neuron, Architectures, learning methods - Evolution of neural networks- important technologies – Taxonomy of ANN Systems, SingleLayer ANN System, Supervised Learning Neural Networks, Perceptrons, Adaline, Backpropagation, Mutilayer Perceptrons Applications of ANN in research. Unsupervised learning networks: Kohonenself organizing feature maps, LVQ – CP networks, ART network. Introduction to MATLAB.

UNIT III: FUZZY SET THEORY & FUZZY SYSTEMS

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, introduction & features of membership functions, Extension Principle, Fuzzy If-Then Rules, Fuzzy Inference Systems, Sugeno Fuzzy Models, Fuzzification, Defuzzification, Applications of fuzzy systems in basic medical systems.

UNIT IV: GENETIC ALGORITHM

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA

UNIT V: HYBRID and OTHER SOFT COMPUTING TECHNIQUES

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP – **Other Soft computing Techniques** – Simulated Anneling, Ant colony optimization and Particle swarm optimization,

TEXT BOOKS:

1. N.P.Padhy, S.P.Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. Kwang H.Lee, ―First course on Fuzzy Theory and Applications, Springer, 2005.
3. George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.