

<b>Devi Ahilya University, Indore, India Institute of Engineering &amp; Technology</b>				<b>IV Year B.E. (Computer Engineering)</b>			
<b>Subject Code &amp; Name</b>	<b>Instructions Hours per Week</b>			<b>Credits</b>			
<b>8CERE1 Soft Computing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper: 3 Hours</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>5</b>

### **Learning Objectives:**

1. To familiarize with neural networks and learning methods for neural networks.
2. To introduce basics of genetic algorithms and their applications in optimization and planning.
3. To introduce the ideas of fuzzy sets, fuzzy logic and fuzzy inference system.
4. To develop skills thorough understanding of the theoretical and practical aspects of Soft Computing.

**Pre requisites: Analysis of Algorithm, Artificial Intelligence.**

## **COURSE CONTENTS**

### **UNIT-I**

#### **INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS**

Evolution of Computing, Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing, Machine Learning Basics and Fundamentals of Neural Networks and Application.

### **UNIT-II**

#### **NEURAL NETWORKS**

Backpropagation Networks, Architecture: perceptron model, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule coefficient, back propagation algorithm, factors affecting back propagation training, Associative memory, Adaptive Resonance Theory.

### **UNIT-III**

#### **GENETIC ALGORITHMS**

Genetic Algorithm(GA) Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators,

Mutation, Generational Cycle, probability of crossover and probability of mutation, convergence. The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems. Simulated annealing and stochastic models, Boltzmann Machine, Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.

#### **UNIT-IV**

##### **FUZZY LOGIC**

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzyfication & Defuzzifications, Fuzzy Controller, Industrial applications Fuzzy Expert Systems, Fuzzy Decision Making.

#### **UNIT-V**

##### **NEURO, FUZZY MODELING**

Adaptive Neuro, Fuzzy Inference Systems Coactive Neuro, Fuzzy Modeling, Classification and Regression Trees Data Clustering Algorithms, Rule base Structure, Identification, Neuro Fuzzy Control, Case studies.

#### **Course Outcomes:**

Upon Completing the Course, Student will able to:

1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Apply neural networks to pattern classification and regression problems
3. Recognize the feasibility of applying a soft computing methodology for a particular problem
4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
5. Apply genetic algorithms to combinatorial optimization problems.

<b>Co No.</b>	<b>CO</b>	<b>PO</b>
<b>CO1</b>	Learn about soft computing techniques and their applications.	<b>PO1,PO9,PO11</b>
<b>CO2</b>	Analyse various neural network architectures	<b>PO2,PO3,PO5 ,PO11,</b>
<b>CO3</b>	Analyse the genetic algorithms and their applications.	<b>PO2,PO4, PO6</b>
<b>CO4</b>	Fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	<b>PO2,PO4,PO5,</b>
<b>CO5</b>	Engineering problem will be Easy and Optimized result can be achieved through Hybrid Approaches.	<b>PO4,PO5</b>

### CO PO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3								2		3
CO2		2	3		3						3
CO3		3		3		2					
CO4		3		3	3						
CO5				3	3						

### BOOKS RECOMMENDED:

- [1] S. Rajasekaran and G. A. VijaylakshmiPai. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.
- [2] Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
- [3] Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence Bart Kosko, Prentice Hall,1992.
- [4] Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
- [5] David E. Goldberg, “Genetic Algorithms in search, Optimization & Machine Learning” ,Addison-Wesley,1997

### LIST OF EXPERIMENT

1. Write a program in MATLAB to perform Union, Intersection and Complement Operations.
2. Write a program in MATLAB to implement De-Morgan’s Law.
3. Write a program in MATLAB to plot various membership functions.
4. To implement FIS Editor.
5. Generate ANDNOT function using McCulloch-Pitts neural net by MATLAB program.
6. Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets.
7. Write a M-file to calculate the weights for the following patterns using heteroassociative neural net for mapping four input vectors to two output vectors.
8. Write an M-file to store vector [-1 -1 -1 -1] and [-1 -1 1 1] in an auto-associative net. Find weight matrix. Test the net with [1 1 1 1] as input.
9. Write a MATLAB program for maximizing  $f(x)=x^2$  using GA, where x is ranges from 0 to 31. Perform 5 iterations only.
10. Generation of XOR function using back propagation algorithm.