



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

SOFT COMPUTING								
I Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSD08	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	40	60	100
<b>Contact Classes: 45</b>	<b>Total Tutorials: Nil</b>	<b>Total Practical Classes: Nil</b>			<b>Total Classes: 45</b>			

### I. COURSE OVERVIEW:

This course covers the basics of intelligence techniques and methodologies of soft computing that differ from conventional artificial computations. This course is used for approximate calculations to provide imprecise but useable solutions to complex problems. This course includes intelligence systems, artificial neural network models, fuzzy logic and its inference system, and neuro-fuzzy systems. The applications are used in pattern recognition, image processing, computer vision, and information retrieval.

### II. COURSE OBJECTIVES:

The students will try to learn:

1. The fuzzy logic and reasoning for handling uncertainty in problem solving
2. Introduce the ideas of neural networks, and fuzzy logic.
3. The basics of intelligence techniques and methodologies of soft computing
4. The design and analysis of problem-solving using concepts of neural networks, neuro modeling, neural network paradigms.

### III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1	<b>Recognize</b> the importance of knowledge representation and processing in intelligent system	Apply
CO 2	<b>Describe</b> the characteristics and constitutes of soft computing for decision making systems.	Understand
CO 3	<b>Demonstrate</b> the models of artificial neural systems for classification problems.	Apply
CO 4	<b>Apply</b> the learning rules and its working principle for computer vision and image processing applications.	Apply
CO 5	<b>Compare</b> the importance of auto and hetero associative memories for distinct cases of neural network systems.	Apply
CO6	<b>Construct</b> the Genetic algorithm and search space, general genetic algorithms	Apply

### IV. COURSE CONTENT:

#### MODULE-I: INTRODUCTION TO NEURAL NETWORKS (09)

Introduction: Fundamental concept, the evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, backpropagation network, radial basis function network.

## **MODULE-II: ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS (09)**

Associative memory networks: Training algorithms for pattern association, auto-associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks, iterative auto-associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

## **MODULE-III: FUZZY LOGIC (09)**

Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, and non-iterative fuzzy sets.

Membership functions: Fuzzification, methods of membership value assignments, defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

## **MODULE-IV: FUZZY ARITHMETIC (09)**

Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.

## **MODULE-V: GENETIC ALGORITHMS (09)**

Genetic algorithm and search space, general genetic algorithm, operators, generational cycle, stopping condition, constraints, classification, genetic programming, multilevel optimization; Applications: A fusion approach of multispectral images with SAR image for flood area analysis, optimization of traveling salesman problem using genetic algorithm approach, and genetic algorithm-based internet search technique, soft computing-based hybrid fuzzy controllers.

### **V. TEXT BOOKS:**

1. J.S.R.Jang, C.T.Sun, E.Mizutani, "Neuro, Fuzzy and Soft Computing", Pearson Education, 1<sup>st</sup> Edition, 2004.
2. S. N. Sivanandan, S. N. Deepa, "Principles of Soft Computing", Wiley India, 2<sup>nd</sup> Edition, 2007.

### **VI. REFERENCE BOOKS:**

1. S.Rajasekaran, G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 1<sup>st</sup> Edition, 2003.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, 3<sup>rd</sup> Edition, 1997.
3. Stamatios V. Kartalopoulos "Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications", IEEE Press, PHI, New Delhi, 2004.

### **VII. WEB REFERENCES:**

1. <http://www.sctie.iitkgp.ernet.in/>
2. <http://www.rkala.in/softcomputingvideos.php>
3. <http://www.sharbani.org/home2/soft-computing-1>
4. [http://www.myreaders.info/html/soft\\_computing.html](http://www.myreaders.info/html/soft_computing.html)

### **VIII E-Text Books:**

1. <https://www.books.google.co.in/books?id=bVbj9nhvHd4C>
2. <https://www.books.google.co.in/books?id=GrZHPgAACAAJ&dq=1.+J.S.R.Jang,+C.T.Sun+and+E.Mizutani,+Neuro,+Fuzzy+and+Soft+Computing,+PHI,+2004,Pearson+Education.>