

COURSE HANDOUT

B. Tech (CSE) – 6th Semester

Course Title : **Soft Computing (Open Elective)**

Dated: 20-11-2017

Course Code : CSE 3417

Academic Year : 2017-18

Course Structure : 3-1-0-4

Course Coordinator : Dr. S.S.Gantayat

Instructor(s) : Dr. S.S.Gantayat

Pre-requisite : Mathematics, Statistics

Scope and Objective:

This course enables us to understand the usefulness of Soft Computing Techniques and their applications, deliverables in various existing fields like education, banking, networking, Image processing, pattern recognition, decision making and other real life Applications. It covers the concepts of Supervisory and Un-supervisory learning methodologies and includes Fuzzy logic with its equivalence relations.

The main objective of the course is to:

- Know Soft Computing basics and its branches
- Understand the basic implementation details on Artificial Neural Networks
- Understand fuzzy logic and its application in ANN.
- Understand Evolutionary computing.
- Elaborate discussion on applications of Soft Computing

Text Books:

1. Principles of Soft Computing- S N Sivanandam, SN Deepa, Wiley India, 2011
2. V. Kecman, "Learning and Soft computing", Pearson Education, India

Reference books:

1. George J. Klir and Bo Yuan, "Fuzzy sets and Fuzzy Logic", Prentice Hall, USA, 1995.
2. N. J. Nelsson, "Artificial Intelligence - A New Synthesis", Harcourt Asia Ltd., 1998.
3. D.E. Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y, 1989.
4. S. Haykins, "Neural networks: a comprehensive foundation". Pearson Education, India.

SYLLABUS:

UNIT I:

(10+3)

Basic Elements of Soft Computing: Introduction to soft computing, Fuzzy logic, Neural Networks and Evolutionary Computing, Evolution of soft computing from computational AI to computing intelligence, Machine learning basics.

UNIT II:

(12+3)

Supervised Learning Networks: Artificial Neural Networks- Introduction, Basic models of ANN, important terminologies, Basic Learning Laws, Supervised Learning Networks, Perceptron Networks, Back propagation Network. Radial basis function network and Hopfield Networks.

UNIT III:

(14+5)

Unsupervised Learning Networks: Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks.

UNIT IV:

(9+4)

Introduction to Classical Sets and Fuzzy Sets: Crisp Sets and Fuzzy Sets- operations. Classical Relations and Fuzzy Relations- Cardinality, Properties and composition. equivalence relations.

Course Outcome: At the end of the course students will be able to:

CCS326.1: Identify and Describe Soft Computing Techniques and their roles in Building Intelligent Machines.

CCS326.2: Apply Evolutionary Computing for Typical Optimization Technique.

CCS326.3: Apply Fuzzy Logic and Reasoning to Handle Uncertainty and Solve Engineering Problems.

CCS326.4: Apply Neural Networks to Pattern Classification and Regression Problems.

CCS326.5: Evaluate and Compare Solutions by various Soft Computing Approaches for a Given Problem.

Course Plan:

No. Lecture	Learning Objectives	Topic(s) to be Covered	Chapter in the Text Book / Reference
Unit-1: Basic Elements of Soft Computing			
1.	Overview of Soft Computing	Introduction to Soft Computing	T-1,C-1
2.	Difference between Soft Computing and Hard Computing	Difference between Soft Computing and Hard Computing	T-1,C-1
3.	Understanding Neural Networks	Neural Networks	T-1,C-1
4.	Understanding Fuzzy Logic	Fuzzy Logic	T-1,C-1
5.	Tutorial -1		
6.	Understanding Genetic Algorithm	Genetic Algorithms	T-1,C-1
7.	Understanding the Hybrid Systems & Applications	Hybrid Systems & Applications	T-1,C-1
8.	Learn Evolution of Soft Computing	History of Soft Computing	T-1,C-1
9.	Tutorial -2		
10.	Understanding Machine Learning	Why Machine Learning	T-1,C-1
11.	Understanding Machine Learning (cont..)	Key points in Machine Learning	T-1,C-1
12.	Learning the Objectives of Soft Computing	Summary on Soft Computing	T-1,C-1
13.	Tutorial -3		
Unit-2: Supervised Learning Networks			
14.	Understanding the Learning Laws	Definition of Learning and kinds of Learning (Supervisor, Unsupervisor & Reinforced)	T-1,C-2
15.	Understanding Artificial Neural	Artificial Neural Networks	T-1,C-2

	Networks		
16.	Understanding Biological Neural Networks	Bio-logical Neural Networks, Brain Vs Computer	T-1,C-2
17.	Understanding the basic models of ANN	Artificial Neural Network Models based on Types of Connections	T-1,C-2
18.	Tutorial - 4		
19.	Understanding Activation Functions	Activation Functions	T-1,C-2
20.	Understanding the Important Terminologies	Weights, Bias, Threshold, Learning Rate, Momentum Factor, Vigilance Parameters & Notations	T-1,C-2
21.	Tutorial - 5		
22.	Learn Single layer Perceptron Model	Single layer Perceptron Model with Example	T-1,C-3
23.	Learn Single and Multilayer Layer Perceptron Models	Difference between Single and Multilayer Layer Perceptron models	T-1,C-3
24.	Learn Backpropagation Network	Backpropagation Network	T-1,C-3
25.	Learn Back Propagation Network (Cont.)	Backpropagation Network with Example	T-1,C-3
26.	Learn Radial Basis Functions(RBF)	Radial Basis Functions(RBF) with Example	T-1,C-3
27.	Learn Hopfield Networks	Hopfield Networks with Example	T-1,C-4
28.	Tutorial - 6		
Unit-3: Unsupervised Learning Networks			
29.	Understanding the Unsupervised Learning Network	Unsupervised Learning Network	T-1,C-5
30.	Learn Fixed Weight Competitive Nets	MaxNet with Example	T-1,C-5
31.	Learn Fixed Weight Competitive Nets (Cont.)	Hamming Network with Example	T-1,C-5
32.	Tutorial - 7		
33.	Learn Kohonen Self-Organizing Feature Maps	Definition of KSOFM and its Architecture	T-1,C-5
34.	Learn Kohonen Self-Organizing Feature Maps (Cont.)	Kohonen Self-Organizing Feature Maps Training Algorithm	T-1,C-5
35.	Tutorial - 8		
36.	Understand the Learning Vector Quantization (LVQ)	Learning Vector Quantization (LVQ)-Architecture	T-1,C-5
37.	Understand the Learning Vector Quantization (LVQ) (Cont.)	Learning Vector Quantization (LVQ) - Algorithm with Example	T-1,C-5
38.	Tutorial - 9		
39.	Learn the Counter propagation Networks (CPN)	Counter Propagation Networks and Types	T-1,C-5
40.	Learn the Counter Propagation Networks(CPN) (Cont.)	Full Counter Propagation Networks - Architecture with Algorithm	T-1,C-5
41.	Learn the Forward only CPN	Forward only CPN Architecture with Algorithm	T-1,C-5
42.	Tutorial - 10		
43.	Learn the Adaptive Resonance Theory Networks (ART)	Introduction to ART and Types	T-1,C-5

44.	Learn the ART1 architecture and algorithm	ART1 Architecture and Algorithm	T-1,C-5
45.	Learn the ART2 architecture and algorithm	ART2 Architecture and Algorithm	T-1,C-5
46.	Tutorial - 11		
Unit – 4: Introduction to Classical Sets and Fuzzy Sets			
47.	Understand the Classical Sets (Crisp Sets)	Definition of Classical Sets (Crisp Sets) with Examples	T-1,C-7
48.	Learn the Classical Set Operations	Classical Set Operations	T-1,C-7
49.	Understand the Fuzzy Sets	Definition of Fuzzy Sets with Examples	T-1,C-7
50.	Learn the Fuzzy Set Operations	Fuzzy Set Operations	T-1,C-7
51.	Tutorial - 12		
52.	Understand the Membership Functions	Membership Functions with Example	T-1,C-9
53.	Learn the Classical relations and Composition of Classical Relations	Classical Relations and Compositions with Examples	T-1,C-8
54.	Tutorial - 13		
55.	Learn the Fuzzy Relations	Fuzzy Relations with Examples	T-1,C-8
56.	Learn the Composition of Fuzzy Relations	Composition of Fuzzy Relations	T-1,C-8
57.	Tutorial - 14		
58.	Learn the Classical Equivalence Relations	Classical Equivalence Relations with Examples	T-1,C-8
59.	Learn the Fuzzy Equivalence Relations	Fuzzy Equivalence Relations with Examples	T-1,C-8
60.	Tutorial – 15		

Evaluation Scheme:

Component	Duration (minutes)	Marks	% of weightage	Date & Time	Venue
Sessional Test – 1	90	20	20%	02.01.2018 to 06.01.2018	Block-5
Sessional Test – 2	90	20		19.02.2018 to 24.02.2018	Block-5
Sessional Test – 3	90	20		02.04.2018 to 07.04.2018	Block-5
Comprehensive Quiz Examination	20	10	10%	02.04.2018 to 07.04.2018	Block-5
Comprehensive Exam	180	70	70%	16.04.2018 to 28.04.2018	As per Exam Section

Chamber Consultation Hour: 4.00 PM
Notices: CSE Main Notice Board

Venue: CSE Staff Room-1 (5-S-01)

Dr. S. S. Gantayat
Signature of the Instructors

Dr. S. S. Gantayat
Signature of the Course-Coordinator