Subject Name : Soft Computing
Subject Code : IT 802-3 / CE 802-3

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
03	00	02	05	4	03	70	30	20	30	150

Learning Objectives:

The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.

Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Introduction of Soft computing and Hard computing	4
2	Neural Networks	10
3	Fuzzy Logic	8
4	Genetic Algorithm	8
5	Hybrid System	5
6	GA and Fuzzy based Backpropagation Network	10

Total hours (Theory): 45
Total hours (Lab): 30
Total hours: 75

Detailed Syllabus:

Sr. No	Topic	Lecture Hours	Weightage(%)
1	**Introduction:** What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.	4	10
2	**Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons , Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.	10	24
3	**Fuzzy Systems:** Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.	8	18
4	**Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.	8	18
5	**Hybrid Systems:** Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.	5	10
6	**GA based Backpropagation Networks:** GA based Weight Determination, K - factor determination in Columns.	5	10
7	**Fuzzy Backpropagation Networks:** LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks.	5	10

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of Multi-media projector, Green board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.

- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Reference Books:

- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.
- Genetic Algorithms: Search and Optimization, E. Goldberg.
- Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
- Build_Neural_Network_With_MS_Excel_sample by Joe choong.

List of experiments:

Sr. No	Name of Experiment
1	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
2	Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3	Train the autocorrelator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, -1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
4	Train the hetrocorrelator using multiple training encoding strategy for given patterns: A_1=(000111001) B_1=(010000111), A_2=(111001110) B_2=(100000001), A_3=(110110101) B_3(101001010). Test it using pattern A_2.
5	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
6	Solve Greg Viot's fuzzy cruise controller using MATLAB Fuzzy logic toolbox.
7	Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox
8	Implement TSP using GA.