

Course Code	Course Name	Teaching Scheme (Hrs/Week)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
BEITC8045	Soft Computing	04	02	---	04	01	---	05

Subject Code	Subject Name	Examination Scheme								
		Theory Marks					Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam					
		Test 1	Test 2	Avg. of 2 Tests						
BEITC8045	Soft Computing	20	20	20	80	25	---	25	150	

Course Objectives:

AIM: To introduce the techniques and methodologies of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

- To introduce the ideas of soft computational techniques based on human experience.
- To generate an ability to design, analyze and perform experiments on real life problems using various Neural Learning Algorithms.
- To conceptualize fuzzy logic and its implementation for various real world applications.
- To apply the process of approximate reasoning using Neuro-Fuzzy Modeling.
- To provide the mathematical background to carry out optimization using genetic algorithms.

Course Outcomes:

Student should be able to mimic human like thought process on deterministic machines and apply it to different real world problems faced in the professional front.

DETAILED SYLLABUS:

Sr.No.	Module	Detailed Content	Hours
1	Introduction to Soft Computing	Neural Networks: Definition, Advantages, Applications, Scope. Fuzzy logic: Definition, Applications. Hybrid System: Definition, Types of Hybrid Systems, Applications. Genetic Algorithms: Definition, Applications.	2
2	Neural Networks	Fundamental Concepts and Models of Artificial Neural Systems: Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Neural Processing, Learning and Adaptation, Neural Network Learning Rules and Comparison. Linearly and Non-Linearly Separable Pattern Classification. Perceptron Convergence Theorem. Multi-layer Feedforward Network: Delta Learning Rule for Multiperceptron Layer, Generalized Delta Learning Rule, Feedforward Recall and Error Back-propagation Training, Learning Factors, Character Recognition Application. Associative Memory: Hopfield Network, Bidirectional Associative Memory. Radial Basis Function Networks.	20
3	Fuzzy Set Theory	Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions. Fuzzy Extension Principle, Fuzzy Relations, Projection and Cylindrical Extension of Fuzzy Relations, Fuzzy Max-Min and Max-Product Composition. Fuzzy Knowledge Based Systems with Applications, Defuzzification Methods, Fuzzy Composition Rules, Architecture of Mamdani Type Fuzzy Control Systems.	16
4	Hybrid Systems	ANFIS: Adaptive Neuro-Fuzzy Inference Systems: Introduction, ANFIS Architecture, and Hybrid Learning Algorithm.	4
5	Genetic Algorithms	What are Genetic Algorithms? Why Genetic Algorithms? Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Natural Selection, Traditional Optimization and Search Techniques, Genetic Algorithm and Search space: Simple GA, General GA, Operators in GA, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA flow, Constraints in GA, Problem solving using GA, Classification of GA.	6

Text Books:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3rd ed. Wiley India.
3. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 2nd ed. Wiley India.
4. Jang J.S.R, Sun C. T. and Mizutani E., "Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Machine Intelligence," PHI.

References:

1. Laurene Fausett, "Fundamentals of Neural Networks – Architectures, Algorithms, And Applications," Pearson Education.
2. Hagan T. Martin, H. B. Demuth, and Mark Beale, "Neural Network Design," Thomson Learning.
3. Satish Kumar, "Neural Networks – A classroom Approach," 2nd ed. Tata McGraw Hill.
4. Kishan Mehrotra, Chilukuri. K. Mohan, and Sanjay Ranka, "Elements of Artificial Neural Networks," 2nd ed. Penram Int. Publishing India.
5. H. J. Zimmermann, "Fuzzy Set Theory and its Applications," Allied Publishers Ltd.
6. Driakov D. Hellendoorn H. and Reinfrank M., "An Introduction to Fuzzy Control," Narosa Publishing House.

Term work:

Term work will be based on Practical and Assignments covering the topics of the syllabus.

Suggested Practical List (If Any):

1. Fuzzy membership function
2. Fuzzy Extension principle
3. Fuzzy controller
4. Perceptron Learning rule
5. Delta Learning Rule
6. Associative Memory
7. Genetic Algorithm
8. Competitive Learning

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.
- Total 4 questions need to be solved.
- Q.1 will be compulsory, based on entire syllabus where in sub questions of 2 to 3 marks will be asked.
- Remaining question will be randomly selected from all the modules.

Weight age of marks should be proportional to number of hours assigned to each module.