

Devi Ahilya University, Indore, India Institute of Engineering & Technology				III Year B.E. (Electronics and Telecommunication)			
Subject Code & Name	Instructions Hours per Week			Credits			
ETR6E3 SOFT COMPUTING TECHNIQUES	L	T	P	L	T	P	Total
Duration of Theory Paper: 3 Hours	3	1	2	3	1	1	5

Learning Objectives: To provides an understandable approach to Soft Computing based methods for problem solving by combining different methods of AI, fuzzy systems, and neural networks

Prerequisite: Overview of Artificial Intelligence and Digital systems

COURSE CONTENTS

Unit -I

Fuzzy Set Theory and Fuzzy Relations:

Classical Sets and Fuzzy Sets, Classical Set. Operations on Classical Sets, Properties of Classical Sets, Mapping of Classical Sets to a Function, Fuzzy Sets , Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations, Cartesian Product of Classical Relations , Fuzzy Relations, Tolerance and Equivalence Relations, Fuzzy Numbers, Fuzzy Arithmetic, Alpha cut, MATLAB based Exercises.

Unit – II

Introduction to Fuzzy Inference System:

Membership Functions,Introduction, Features of Membership Function, Classification of Fuzzy Sets ,Fuzzification, Membership Value Assignments, Defuzzification, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods , Fuzzy Rule-Based System, Formation of Rules ,Decomposition of Rules, Aggregation of Fuzzy Rules, Properties of Set of Rules,Fuzzy Inference System, Fuzzy Inference Methods, Mamdani’s Fuzzy Inference Method,Takagi–Sugeno Fuzzy Method (TS Method) , MATLAB based problems.

Unit-III

Neural Networks and Perceptron model

Introduction to Neural Network. Models of a Neuron. Network Architectures. Learning Processes. Supervised and Unsupervised Learning, Perceptron. Back-Propagation Algorithm. XOR Problem. Generalization. Approximations of Functions. Self-Organizing Map algorithm. Learning Vector Quantization, MATLAB based problems.

Unit-IV

Fuzzy Neural Networks

Integration of fuzzy logic and neural networks ,Fuzzy Hybrid neural, Computation of fuzzy logic inferences by hybrid neural net, Tuning fuzzy control parameters by neural nets, Fuzzy rule extraction from numerical data, Neuro-fuzzy classifiers, ANFIS, Applications of fuzzy neural systems, MATLAB based problems

Unit V

Genetic Algorithms

Introduction, Structure of Evolutionary Algorithms, Components of Evolutionary Algorithms, Representation, Evaluation/Fitness Function, Population Initialization, Selection, Recombination, Mutation, Reinsertion, Multi-objective Evolutionary Algorithms, and MATLAB based problems

Learning Outcomes:

At the end of this course, students will be able to:

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Recognize the feasibility of applying a soft computing methodology for a particular problem
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
- Apply genetic algorithms to combinatorial optimization problems
- Apply neural networks to pattern classification and regression problems
- Effectively use existing software tools to solve real problems using a soft computing approach
- Evaluate and compare solutions by various soft computing approaches for a given problem.

BOOKS RECOMMENDED:

- [1] S. Haykin, “Neural Networks: A Comprehensive Foundation”, Prentice Hall, 1999.
- [2] G J Klir and T A Folger, "Fuzzy sets, uncertainty, and information", Prentice-Hall, 1992.
- [3] D. Driankov, H. Hellendoorn and M Reinfrank, "An introduction to fuzzy control", Springer-Verlag, 1993.
- [4] G J Klir and B Yuan, "Fuzzy Sets and Fuzzy Logic - Theory and Applications", Prentice-Hall, 1995.
- [5] C. Bishop, “Neural Networks for Pattern Recognition”, Oxford University Press, 1995.

List of Practical Assignments:

1. Write A Program For Implementing Linear Saturating Function.
2. Study And Analysis Of Art Model.
3. Write A Program For Error Back Propagation Algorithm (Ebpa) Learning.
4. Study And Analysis Of CPN
5. Study And Analysis Of Genetic Algorithm Life Cycle.
6. Study And Analysis Of Fuzzy Vs Crisp Logic.
7. Write A Program Of Perceptron Training Algorithm.
8. Write A Program To Implement Hebb's Rule
9. Write A Program To Implement Of Delta Rule
10. Write A Program For Back Propagation Algorithm
11. Write A Program To Implement Logic Gates