

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech CSE (Artificial Intelligence & Machine Learning)
Course Code:	XXXX
Course Title:	Soft Computing
Course Type:	Department Elective-II
Year of Introduction:	2024-25

L	T	Practical Component				C
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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to–

1. identify the application of fuzzy logic (BL3)
2. assess optimization problems using Multi-Objective Evolutionary algorithms (MOEAs) (BL5)
3. solve problems in a variety of application domains using soft computing techniques (BL6)
4. propose various solutions for optimization problems using genetic algorithms. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	Introduction to Soft Computing: Concept of computing systems, soft competing versus Hard computing, Characteristics of Soft computing, Some applications of soft computing techniques	05
Unit-II	Fuzzy logic: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques., Fuzzy logic controller design, Some applications of Fuzzy logic.	10
Unit-III	Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.	12
Unit-IV	Multi-objective Optimization Problem Solving: Concept of multi-objective optimization problems (MOOPs) and issues of solving them, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Pareto-based approaches to solve MOOPs, Some applications with MOEAs.	13
Unit-V	Artificial Neural Networks: Biological neurons and their working, Simulation of biological neurons to problem-solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.	05

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.



Suggested Readings/ References:

1. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley.
2. S N Sivanadam and S N Deepa, Principles of Soft Computing, Wiley
3. Siman Haykin, Neural Networks, Prentice Hall of India.
4. S. Rajasekaran, G.A. Vijayalakshmi Pai, Neural Networks, fuzzy logic, and genetic algorithms - Genetic Algorithm, Prentice Hall India.
5. F. Martin, McNeill, and Ellen Thro, Fuzzy Logic: A Practical Approach, AP Professional.
6. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley
7. Nikola K. Kasabov, Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, MIT Press
8. Ahmed M. Ibrahim, Fuzzy Logic for Embedded Systems Applications, Elsevier
9. Melanie Mitchell, An Introduction to Genetic Algorithms, MIT Press
10. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education
11. Randy L. Haupt and Sue Ellen Haupt, Practical Genetic Algorithms, John Wiley & Sons
12. S. Rajasekaran, and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, Prentice Hall of India
13. D. K. Pratihar, Soft Computing, Narosa

Laboratory Work:

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of Laboratory work.

Sr. No.	List of Experiments/Exercises	Hours
1	Introduction to Python and its environment to set up the Soft Computing Practical.	02
2	Introduction to fuzzy logic packaging	02
3	Implement any one application to demonstrate the use of fuzzy logic	04
4	Introduction to Genetic Algorithm Packaging	02
5	Implement one application to demonstrate the use of a Genetic Algorithm	04
6	Demonstrate various selection strategies of the genetic algorithm	02
7	Introduction to Neural Network Packages	02
8	Implement one application to demonstrate the use of Neural Networking	04
9	Test the Performance of various architectures on any application	04
10	Demonstrate the effect of various parameters on the Neural Network	04