GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720217
Semester – II
Subject Name: Soft Computing

Type of course: Core Course

Prerequisite: Basic Knowledge of Mathematics

Rationale: To introduce the soft computing concepts and techniques and to foster their abilities in designing appropriate technique for a given scenario. To implement soft computing based solutions for real world problems. T give students knowledge about non-traditional techniques and fundamentals of artificial neural networks, fuzzy logic and genetic algorithms. To provide students hands-on experience on MATLAB to implement various strategies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Unit 1 : INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics	7	14
2	**Unit 2: FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	9	20
3	**Unit 3: NEURAL NETWORKS:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks	10	20
4	**Unit 4: GENETIC ALGORITHMS:** Goals of optimization, comparison with traditional methods, schemata, Terminology in GA – strings, structure, parameter string, data structures, operators, coding fitness function, algorithm, applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.	9	20
5	**Unit 5: Matlab/Python Lib:** Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic	10	20
6	**Unit 6 :** Recent Trends in various classifiers, neural networks and genetic algorithm	3	06

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Reference Books:

1. Jyh Shing Roger Jang, Chuen Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
3. MATLAB Toolkit Manual
4. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill
5. Goldberg, D. E, Genetic algorithm in search, optimization and machine learning, Addison-Wesley, Reading Mass
6. S.N.Sivanandam, S.N.Deepa , Principles of Soft Computing, 2e, Wiley India Pvt. Ltd.
7. S. RAJASEKARAN, G. A. VIJAYALAKSHMI PAI, NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND APPLICATIONS, PHI Learning Pvt. Ltd

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and describe soft computing techniques and their roles in building intelligent machines.	**20**
CO-2	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.	**20**
CO-3	Apply genetic algorithms to combinatorial optimization problems.	**20**
CO-4	Evaluate and compare solutions by various soft computing approaches for a given problem.	**20**
CO-4	Use various tools to solve soft computing problems.	**20**

Suggested List of Experiments: If MATLAB is not available, the practical may be carried out in SCILAB or C/C++/Java

1. Introduction to MATLAB & its environment.
2. Introduction to MATLAB: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos
3. Introduction to MATLAB: Neural Network (NN) Toolbox, NN Simulink Demos
4. MATLAB simulation: Artificial Neural Network (ANN) implementation
5. MATLAB simulation: NN Tool Artificial Neural Network (ANN) implementation
6. MATLAB simulation: Various structure of NN algorithms implementation
7. MATLAB simulation: Training Algorithms of ANN.
8. MATLAB simulation: Coding and minimizing a fitness function using GA.

List of Open Source Software/learning website:

1. http://www.iitk.ac.in/kangal/codes.shtml
2. http://lancet.mit.edu/ga/dist/galibdoc.pdf
3. https://books.google.co.in/books?hl=en&lr=&id=W5SAhUqBVYoC&oi=fnd&pg=PR11&dq=SOft+computing+course+&ots=et_2Nvjy_4&sig=jDXLrGIeD3zc4QUxvcEvC5FrFY#v=onepage&q=SOft%20computing%20course&f=false

Major Equipments / Software:

Students may implement open ended problems on some Microprocessors / DSP boards. Computers with MATLAB / Scilab/ C/C++/Java software may serve the purpose.