GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3734705
Semester – III
Subject Name: Soft Computing Methods and Applications

Type of course: Engineering

Prerequisite: Zeal to learn the subject

Rationale: This subject deals with Fuzzy logic and Neural Network, which are very important from machine learning point of view. In automation decision making has become simpler with these tools of soft computing.

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)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction to Soft Computing** Introduction, Importance of Soft Computing, Main Components of Soft Computing, Fuzzy Logic, Artificial Neural Networks, Support Vector machine, Evolutionary Algorithms, Hybrid Intelligent Systems.	3
2	**Fuzzy Logic Systems** Introduction to Fuzzy logic, classical sets *vs* fuzzy sets, Features of membership functions, Properties and operations on Fuzzy sets, Fuzzy relation, Operations of Fuzzy relation, Defuzzification, Fuzzy rule base and approximate reasoning, Design a fuzzy logic controller: Mamdani & Sugeno Architecture, Fuzzy logic control systems.	11
3	**Neural Network Systems** Introduction to artificial neural network, Biological neurons *vs* artificial neural network, Neuron models, Network architectures, Learning in neural networks, Back propagation network, Hopfield network, Self-organizing feature maps, Control systems with neural networks.	11
4	**Applications of soft computing** Applications of Fuzzy logic and neural network systems in automation, robotics and machine vision.	4

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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**30**	**15**	**5**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. S. N. Sivanandam and S. N. Deepa, "Principles of Soft computing", Wiley India Edition.
2. K. L. Du and M.N.S. Swamy, "Neural Networks in a Softcomputing framework", Springer
3. Drinkov, "An introduction to fuzzy control", Narosa Publication.

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Develop Fuzzy Inference System for various applications of automation and control.	35
CO-2	Integrate and develop Neural Network for various applications related to machine learning.	35
CO-3	Judge the role played by Mechatronics engineers to automate the process by integrating the knowledge of soft-computing techniques.	30

List of Experiments:

1 Introduction to MATLAB: Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos

2 MATLAB simulation: Fuzzification, Defuzzification, Rule Base, Fuzzy Logic Controller (FLC) implementation.

3 MATLAB simulation: Simulink Fuzzy Logic Controller (FLC) implementation.

4 MATLAB simulation: Application of FLC to Mechatronics System

5 Introduction to MATLAB: Neural Network (NN) Toolbox, NN Simulink Demos

6	MATLAB simulation: Artificial Neural Network (ANN) implementation
7	MATLAB simulation: NN Tool Artificial Neural Network (ANN) implementation
8	MATLAB simulation: Various structure of NN algorithms implementation
9	MATLAB simulation: Various ANN Training Algorithms.
10	MATLAB simulation: Application of NN to Mechatronics System

Major Equipment:

Open Source Software: Scilab or C Other Software(s) MATLAB® (if license available)

List of Open Source Software/learning website:

NPTEL