Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETE703	Neural Networks and Fuzzy Logic	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ETE703	Neural Networks and Fuzzy Logic	20	20	20	80	-	-	-	100

Prerequisites: FEC 101 Applied Mathematics I

Course Objective: To teach students
- Concepts and understanding of artificial neural networks
- Fuzzy logic basic theory and algorithm formulation
- To solve real world problems.

Course Outcome: Students will get:
- Knowledge about different neural networks, their architecture and training algorithm
- Concept of Fuzzy logic, Fuzzy Sets, fuzzy rules and fuzzy reasoning
- Exposure to the applicability of neural networks and fuzzy logic

Module No.		Topics	Hrs.
1.		**Introduction to Neural Networks and its Basic Concepts:**	08
	1.1	Biological neurons and McCulloch and Pitts models of neuron	
	1.2	Types of activation functions	
	1.3	Neural networks architectures	
	1.4	Linearly separable and linearly non-separable systems and their examples	
	1.5	Features and advantages of neural networks over statistical techniques	
	1.6	Knowledge representation, learning process, error-correction learning, concepts of supervised learning, and unsupervised learning	
2		**Supervised Learning Neural Networks:**	07
	2.1	Single layer perception and multilayer perceptron neural networks, their architecture	
	2.2	Error back propagation algorithm, generalized delta rule, learning factors, step learning	
	2.3	Momentum learning	
	2.4	Concept of training, testing and cross-validation data sets for design and validation of the networks	
3		**Unsupervised Learning Neural Networks:**	09
	3.1	Competitive earning networks, kohonen self-organizing networks	
	3.2	K-means and LMS algorithms	
	3.3	RBF neural network, its structure and Hybrid training algorithm for RBF neural networks	
	3.4	Comparison of RBF and MLP networks Learning	
	3.5	Vector Quantization neural network architecture and its training algorithm	
	3.6	Hebbian learning, Hopfield networks.	
4		**Applications of Neural Networks:**	06
	4.1	Pattern classification	
	4.2	Handwritten character recognition	
	4.3	Face recognition	
	4.4	Image compression and decompression	
5		**Fuzzy logic**	14
	5.1	Basic Fuzzy logic theory, sets and their properties	
	5.2	Operations on fuzzy sets	
	5.3	Fuzzy relation and operations on fuzzy relations and extension principle	
	5.4	Fuzzy membership functions and linguistic variables	
	5.5	Fuzzy rules and fuzzy reasoning	
	5.6	Fuzzification and defuzzification and their methods	
	5.7	Fuzzy inference systems, Mamdani Fuzzy models, and Fuzzy knowledge based controllers	
6		**Applications of Fuzzy Logic and Fuzzy Systems:**	08
	6.1	Fuzzy pattern recognition	
	6.2	Fuzzy image processing	
	6.3	Simple applications of Fuzzy knowledge based controllers like washing machines, traffic regulations, and lift control	
		Total	52

Recommended Books:
1. S. Rajsekaran and G. A. Vijaylakshmi Pai, "*Neural Networks, Fuzzy Logic, and Genetic Algorithms*", PHI
2. Simon Haykin, "*Neural Network- A Comprehensive Foundation*", Pearson Education
3. Thimothy J. Ross, "*Fuzzy Logic with Engineering Applications*", Wiley India Publications
4. Laurence Fausett, "*Fundamentals of Neural Networks*", Pearson Education
5. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, "*Introduction to Neural Network Using MATLAB*", Tata McGraw-Hill Publications
6. Bart Kosko, "*Neural networks and Fuzzy Systems*", Pearson Education

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules