



# Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India  
(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
ITC8045	Soft Computing	4	-	-	4	-	-	4
		Examination Scheme						
		ISE		MSE		ESE		
		10	30	100 (60% Weightage)				

Pre-requisite Course Codes	
After successful completion of the course, student will be able to:	
Course Outcomes	CO1 Explain the basic ideas of soft computing techniques.
	CO2 Design fuzzy inference system.
	CO3 Apply neural networks to solve pattern classification problems
	CO4 Illustrate the concept of hybrid systems.
	CO5 Solve optimization problems using genetic algorithms.

Module No.	Topics	Ref.	Hrs
1	<b>Introduction to Soft Computing</b> <b>Neural Networks:</b> Definition, Advantages, Applications, Scope. <b>Fuzzy logic:</b> Definition, Applications. <b>Hybrid System:</b> Definition, Types of Hybrid Systems, Applications. <b>Genetic Algorithms:</b> Definition, Applications.	3,4	2
2	<b>Neural Networks</b> <b>Fundamental Concepts and Models of Artificial Neural Systems:</b> Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Neural Processing, Learning and Adaptation, Neural Network Learning Rules and Comparison. <b>Linearly and Non-Linearly Separable Pattern Classification.</b> <b>Perceptron Convergence Theorem.</b> <b>Multi-layer Feed forward Network:</b> Delta Learning Rule for Multi perceptron Layer, Generalized Delta Learning Rule, Feed forward Recall and Error Back-propagation Training, Learning Factors, Character Recognition Application.	1,3,4,6	20
3	<b>Fuzzy Set theory</b> Brief Review of Conventional Set Theory, Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions. Fuzzy Extension Principle, Fuzzy Relations, Projection and Cylindrical Extension of Fuzzy Relations, Fuzzy Max-Min and Max-	2,3,4,9	16



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	Product Composition. Fuzzy Knowledge Based Systems with Applications, Defuzzification Methods, Fuzzy Composition Rules, Architecture of Mamdani Type Fuzzy Control Systems.		
4	<b>Hybrid Systems</b> ANFIS: Adaptive Neuro -Fuzzy Inference Systems :Introduction, ANFIS Architecture and Hybrid Learning Algorithm.	3,4	04
5	<b>Genetic Algorithm</b> What are Genetic Algorithms? Why Genetic Algorithms? Biological Background: The Cell, Chromosomes, Genetics, Reproduction, Neural Selection, Traditional Optimization and Search Techniques, Genetic Algorithm and Search space: Simple GA, General GA, Operators in GA,Encoding,Selection,Crossover,Mutation,StoppingConditionforGAflow, Constraints in GA, Problem solving using GA, Classification of GA.	3,4	06
	<b>Total hours of instructions</b>		48

## References:

1. Jacek M. Zurada, "Introduction to Artificial Neural Systems," Jaico Publishing House.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," 3<sup>rd</sup> edition Wiley India.
3. S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing," 2<sup>nd</sup> edition. Wiley India.
4. Jang J.S.R, Sun C. T. and Mizutani E., "Neuro-Fuzzy and Soft Computing– A Computational Approach to Learning and Machine Intelligence," PHI.
5. Laurene Fausett, "Fundamentals of Neural Networks– Architectures, Algorithms, And Applications," Pearson Education.
6. Hagan T. Martin, H.B. Demuth, and Mark Beale, "Neural Network Design," Thomson Learning.
7. Satish Kumar, "Neural Networks– A classroom Approach," 2<sup>nd</sup> ed. Tata McGraw Hill.
8. Kishan Mehrotra, Chilukuri. K. Mohan and Sanjay Ranka, "Elements of Artificial Neural Networks," 2<sup>nd</sup> ed. Penram Int. Publishing India.
9. H.J. Zimmermann, "Fuzzy Set Theory and its Applications," Allied Publishers Ltd.
10. Driakov D. Hellendoorn H. and Reinfrank M., "An Introduction to Fuzzy Control," Narosa Publishing House.