Course Code	Course Title	L	T	P	C
BCSE413L	Soft Computing	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To introduce the concepts of neural networks and advanced neural networks.
2. To understand the fundamentals of fuzzy sets, fuzzy logic and rough sets.
3. To establish basic knowledge about optimization techniques and hybrid models in soft computing.

Course Outcomes

1. Have a general understanding of soft computing methodologies, to deal with imprecise and uncertain data
2. Identify and describe soft computing techniques and build supervised learning and unsupervised learning networks.
3. Apply fuzzy logic, rough sets and reasoning methods to handle uncertainty and solve various engineering problems.
4. Apply optimization methods to solve real world problems.
5. Evaluate and compare solutions by various soft computing approaches for a given problem.

Module:1	Introduction to Neural Network	6 hours

Evolution of Neural Network, Mathematical model of neuron, Terminologies of ANN, Characteristics of neural networks, Learning Methods, Early neural network architectures, Application domains, Introduction to Pattern Recognition

Module:2	Memory Models	7 hours

Pattern Association, Auto Associative Memory Networks, Hetero Associative Memory Networks, Bidirectional Associative Memory, Hopfield networks

Module:3	Unsupervised Learning Algorithms	7 hours

Self-Organizing Maps, Kohonen Network, Adaptive Resonance Theory (ART), algorithms and Illustration of ART1 and ART2 model, Related Applications

Module:4	Fuzzy Sets and Fuzzy Relations	7 hours

Crisp Sets, Fuzzy sets, Membership functions, fuzzy set operations, properties of Fuzzy sets, Crisp Relations, Fuzzy relations, Operations of Fuzzy Relations- Fuzzy Logic, Fuzzy Inference systems, Fuzzy knowledge based systems, Fuzzy Decision making

Module:5	Fuzzy and Neuro Fuzzy Modeling	6 hours

Fuzzy clustering, Fuzzy C-Means Clustering, Fuzzy Classification Algorithms - Fuzzy Decision Trees – Fuzzy SVM - Neuro Fuzzy Modeling – Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling - Fuzzy Rule based Structure Identification – Neuro-Fuzzy Control.

Module:6	Rough sets	5 hours

Fundamentals of Rough sets, Rough Approximations and their properties, Measures of Accuracy, Rough Membership function and properties, Attribute reduction using Rough sets, Knowledge representation systems using Rough sets, Decision tables, Rule induction, Discernibility matrix, Class - Classification using neuro Fuzzy rough sets.

Module:7	Optimization Techniques	5 hours

Introduction, Genetic Algorithms, Memetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization, Grey wolf optimization - Hybrid Models, Neuro genetic algorithms - Applications		
Module:8	**Recent Trends**	**2 hours**
Guest lectures from Industry and Research and Development Organizations		
	Total Lecture hours:	**45 hours**
	Text Book(s)	
1.	Principles of Soft Computing, 3rd Edition by Sivanandam & Deepa, Wiley India, 2018	
	Reference Books	
1.	S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI, 2nd Edition 2017.	
2.	B.K.Tripathy, J.Anuradha," Soft Computing – Advances and Applications", Cengage Learning, 2015.	
3.	Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2009.	
	Mode of Evaluation: CAT / Written Assignment / Quiz / FAT	

Recommended by Board of Studies	12-05-2023		
Approved by Academic Council	No. 70	Date	24-06-2023