SEMESTER S4

SOFT COMPUTING

Course Code	PCCPT403	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	GBMAT101, GBMAT201, UCEST105, GBEST204, PBCPT304	Course Type	Theory

Course Objectives:

1. To explain various components of soft computing like fuzzy logic, neural networks and genetic algorithm.
2. To understand the fundamentals of Fuzzy sets, including properties, operations and membership functions.
3. To summarize the fuzzy inference systems and defuzzification methods.
4. To understand the principles of MOO and Neuro-Fuzzy hybrid systems, including classification and characteristics.

SYLLABUS

KTU SPECIAL

Module No.	Syllabus Description	Contact Hours
1	Introduction to Soft Computing, Difference between Hard Computing & Soft Computing & Applications of Soft Computing, Artificial Neurons Vs Biological Neurons, Basic models of artificial neural networks, Activation Functions, McCulloch and Pitts Neuron, Hebb network, Perceptron networks – Learning rule, Training and testing algorithm	11
2	Adaptive Linear Neuron, Back propagation Network, Introduction to Fuzzy Set, Properties & operations on fuzzy sets, Fuzzy membership functions, Fuzzification, Methods of membership value assignments, Fuzzy relations, Operations on Fuzzy Relation, Fuzzy Propositions & Fuzzy Implications, Lamda cuts for fuzzy sets	11
3	Defuzzification methods, Fuzzy Inference Systems - Mamdani type, Fuzzy Inference Systems - Sugeno type, Fuzzy Logic Controller, Introduction to genetic algorithm, operators in genetic algorithm – coding, Selection, Cross over, Mutation, stopping condition for genetic algorithm	11

4	MOOP-Linear & Nonlinear, Convex & Non Convex, Principles of MOO-Illustrating Pareto Optimal Solutions, Objectives in MOOP, Dominance & Pareto-Optimality-Concept of Domination, Properties of Dominance Relation, Pareto Optimality, Procedure for finding a non dominated set, Optimality Conditions, Neuro Fuzzy hybrid system-Classification & characteristics, Genetic – neuro hybrid systems	**11**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

KTU SPECIAL

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 3 marks **(8x3 =24 marks)**	Each question carries 9 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamental differences between hard computing and soft computing	**K2**
CO2	Understand the basic models of artificial neural networks, activation functions and principles of learning	**K2**
CO3	Summarize fuzzy set theory for performing operations such as fuzzification, defuzzification, and utilization fuzzy inference systems for decision-making processes.	**K2**
CO4	Identify genetic algorithms to solve optimization problems with multiple objectives (MOOP).	**K3**
CO5	Construct hybrid systems such as neuro-fuzzy and genetic-neuro hybrids in solving complex engineering problems.	**K3**

Note: *K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

KTU SPECIAL

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1		1							
CO2	3	2	1		1							
CO3	3	3	2		1							
CO4	3	3	2	1	2							
CO5	3	3	3	2	2							

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fuzzy Logic with Engineering Applications	Timothy J. Ross	John Wiley and Sons	3/e, 2010
2	Fuzzy Sets and Fuzzy Logic Theory and Applications	George J. Klir and Bo Yuan	Prentice Hall	1/3, 1995

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Applied Fuzzy Electronics	Ibrahim A. M.	Prentice Hall	2/e, 2013
2	Fuzzy Logic: Intelligence, Control and Information	J. Yen, R. Langari	Pearson Education	2/e, 1998

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1 - 4	https://nptel.ac.in/courses/127105006

KTU SPECIAL