



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: All (Except Computer Engineering & Allied Branches)

Subject Code: BE05000461

Subject Name: Fuzzy Logic and Genetic Programming

w.e.f. Academic Year:	2024-25
Semester:	5
Category of the Course:	MOPEC

Prerequisite:	Basic understanding of computer and programming
Rationale:	The motivation for studying Fuzzy Logic and Genetic Algorithms (GA), typically taught under soft computing or computational intelligence, comes from their effectiveness in tackling complex, real-world problems where traditional deterministic approaches often fall short. These methods are designed to handle uncertainty, imprecision, and non-linear relationships, making them well-suited for scenarios where exact models are difficult to define or compute

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	Marks% weightage
1	Understand foundational concepts	25
2	Model uncertainty using fuzzy logic	20
3	Apply Genetic Algorithms for optimization	15
4	Analyze and compare soft computing techniques	15
5	Develop real-world intelligent solutions	15

*Revised Bloom's Taxonomy(RBT)

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credit s = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA (I)	PBL (I)	ESE (V)	
45	0	0	15	60	02	70	30	20	30	50	200

* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

Course Content:

Unit No.	Content	No. of Hours
1	Introduction to Soft Computing: Soft computing vs hard computing, Characteristics and applications, Components: Fuzzy Logic, Genetic Algorithms, Real-world applications	4



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2.	Fuzzy Logic Fundamentals: Crisp sets vs fuzzy sets, Membership functions (triangular, trapezoidal, Gaussian), Operations on fuzzy sets, Fuzzy relations and properties	8
3.	Fuzzy Inference Systems: Fuzzification methods, defuzzification methods, Fuzzy rule-based systems, Mamdani and Sugeno models, Fuzzy controller design	10
4.	Genetic Algorithms - Concepts: Fundamentals, basic concepts, Basic structure of GA, encoding, fitness function, reproduction	6
5.	Genetic Algorithms - Operations: Genetic modeling: inheritance operators, cross over, inversion and deletion, mutation operator, bitwise operator, generational cycle, Convergence of GA, application and advance in GA, difference and similarity between GA, and other traditional methods	12
6	Advanced GA & Hybrid System: Optimization problems using GA, Fuzzy-Genetic algorithm	5
Total		45

Suggested Specification Table with Marks(Theory):

Distribution of Theory Marks (in%)					
RLevel	ULevel	ALevel	NLevel	E Level	CLevel
15	25	25	25	--	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. S. N. Deepa and S. N. Sivanandam, "Principles of Soft Computing", 2nd Edition, Wiley, 2011.
2. S. Rajasekaran, G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", 1st Edition, Prentice Hall of India, 2003
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Second Edition, Wiley India
4. Samir Roy, Udit Chakraborty, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", 1st Edition, Pearson India Education, 2013
5. Goldberg, David E. "Genetic Algorithms in Search, Optimization & Machine Learning", 1st Edition, Pearson Education, 1989

(b) Open source software and website:

NPTEL Course:

1. Introduction to Soft Computing By Prof. Debasis Samanta | IIT Kharagpur
2. Soft Computing Techniques By Prof. Santimoy Kundu | IIT Dhanbad
3. Fuzzy Logic and Neural Networks By Prof. Dilip Kumar Pratihar | IIT Kharagpur
