



VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 120014

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025

Seventh Semester

Biomedical Engineering

U19BMV48 – SOFT COMPUTING TECHNIQUES

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Distinguish between supervised and unsupervised learning.	2	K2	CO1
2.	State the objective of back propagation algorithm.	2	K2	CO1
3.	In a Sugeno fuzzy inference system, what type of output is typically used in the rule consequent, and how is the final output computed?	2	K2	CO2
4.	List the main steps involved in converting fuzzy inputs into crisp outputs in a Fuzzy Inference System.	2	K2	CO2
5.	Specify the role of the crossover operator in a Genetic algorithm and how does it contribute to solution diversity?	2	K2	CO3
6.	Define the term “fitness function” in the context of Genetic algorithms and indicate its significance in the selection process.	2	K1	CO3
7.	In Particle Swarm Optimization, what do the terms “velocity” and “position” represent in the context of finding optimal solutions?	2	K1	CO4
8.	Decentralized control in swarm intelligence systems contribute to robustness and scalability in solving complex problems. Justify the statement.	2	K2	CO4
9.	Describe how EELM can be used for classification of non-linearly separable data.	2	K2	CO5
10.	Mention the significance of the margin in Support Vector Machines.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Artificial Neural Networks (ANNs) are foundational to soft computing and intelligent systems. Explain the key components of an ANN and describe their roles in learning and decision-making with a labeled diagram.	13	K4	CO1
	(OR)			
b)	Reinforcement Learning (RL) mimics behavioral psychology by rewarding desirable actions and penalizing undesirable ones. Critically examine how RL principles align with human learning and decision-making. Discuss the ethical implications of using RL in autonomous systems such as surveillance drones.	13	K4	CO1
12. a)	Explain the process of fuzzy reasoning in a fuzzy inference system. Discuss the role of fuzzy rules, rule base, and defuzzification. How does fuzzy reasoning differ from classical logical reasoning? Illustrate your answer with a generic example.	13	K4	CO2
	(OR)			
b)	Tsukamoto Fuzzy Models are a type of fuzzy inference system known for their monotonic output functions. Explain the structure and working principle of a Tsukamoto Fuzzy Model. Describe how fuzzy rules are formulated and how the crisp output is obtained through rule-based reasoning.	13	K4	CO2
13. a)	Explain the key components of a Genetic Algorithm, including selection, crossover, mutation, and fitness function. Illustrate the working of GA with a suitable example and discuss its advantages over traditional search methods.	13	K5	CO3
	(OR)			
b)	A logistics company wants to optimize delivery routes for its fleet of vehicles to minimize fuel consumption and delivery time. The company uses a Genetic Algorithm to solve this multi-objective optimization problem. Define a suitable fitness function that balances both fuel efficiency and delivery speed. Analyze how changes in the fitness function design could affect convergence and solution quality.	13	K5	CO3
14. a)	Elucidate the principle behind Cauchy's Steepest Descent Method and compare its efficiency and limitations with other gradient-based optimization techniques.	13	K5	CO4
	(OR)			

	b)	Examine the working principles of the Artificial Bee Colony Algorithm and illustrate the algorithm with a suitable optimization example and discuss its advantages over traditional search methods.	13	K5	CO4
15.	a)	Explain the architecture and working principle of a neuro-fuzzy system. Discuss how fuzzy rules are adapted through neural learning. Illustrate your answer with a block diagram and a suitable example from control systems or decision-making applications.	13	K3	CO5

(OR)

	b)	Analyze the working principle of the Random Forest algorithm, highlighting the roles of decision trees, bootstrapping, and feature randomness. Use a simple example to demonstrate its functioning, and evaluate how Random Forest enhances accuracy and mitigates overfitting compared to a single decision tree.	13	K3	CO5
--	----	--	----	----	-----

PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	A hospital wants to develop a decision-support system to assess patient discomfort levels based on inputs like body temperature, heart rate, and pain intensity. Design fuzzy sets for each input parameter and define appropriate membership functions. Construct a fuzzy inference system to classify discomfort levels (e.g., low, moderate, high). Justify your choice of membership functions and discuss how this system improves decision-making compared to crisp logic.	15	K4	CO2
(OR)				
b)	A smart irrigation system is being developed to optimize water usage based on three input parameters: soil moisture, ambient temperature, and crop type. Design fuzzy sets and membership functions for each input and implement a Mamdani Fuzzy Inference System to determine the appropriate irrigation level. Justify your choice of fuzzy rules and defuzzification method, and explain how Mamdani modeling improves decision-making compared to rule-based or threshold systems.	15	K4	CO2