

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3172009

Date: 08/06/2026

Subject Name: Soft Computing

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) Define the concept of "Soft Computing" and explain why it is preferred over Hard Computing for non-linear, uncertain mechatronic systems. **03**
 - (b) Explain triangular and trapezoidal membership functions with suitable examples **04**
 - (c) Develop a complete framework for a Fuzzy Logic Controller to maintain the water level in a tank. Define the input variables, membership functions, and at least four fuzzy rules. **07**
- Q.2**
- (a) List different types of fuzzy relations. **03**
 - (b) Explain the concept of approximate reasoning in fuzzy logic systems. **04**
 - (c) Design a fuzzy inference system for automatic room temperature control. **07**
- OR
- Q.2**
- (c) Explain Sugeno fuzzy inference architecture with suitable block diagram and application. **07**
- Q.3**
- (a) Differentiate between a "Biological Neuron" and an "Artificial Neuron" in terms of processing speed and fault tolerance. **03**
 - (b) Explain how Soft Computing techniques are integrated into Machine Vision for industrial quality control. **04**
 - (c) Distinguish between supervised and unsupervised learning networks, with example. **07**
- OR
- Q.3**
- (a) What is the significance of "Alpha-cut" (α -cut) in fuzzy set theory? **03**
 - (b) Compare Fuzzy Logic and Crisp Logic **04**
 - (c) Describe Adaptive Resonance Theory (ART) network and explain its applications **07**
- Q.4**
- (a) Define chromosome and fitness function in Genetic Algorithm **03**
 - (b) For a fuzzy set $A = \{0.1/1, 0.3/2, 0.7/3, 1.0/4, 0.5/5\}$, find the crisp value using the Centroid (Center of Gravity) and Mean of Maxima defuzzification methods. **04**
 - (c) Solve an optimization problem using Genetic Algorithm with suitable encoding and crossover operation **07**
- OR
- Q.4**
- (a) Define Hybrid Intelligent System and state its advantages **03**
 - (b) Describe the Support Vector Machine (SVM) architecture and its use in pattern recognition. **04**

	(c) Explain Supervised Learning Network - Perceptron, ADALINE, MADALINE, Back propagation network .	07
Q.5	(a) State applications of Neuro-Fuzzy systems in industrial automation	03
	(b) Explain Genetic-Fuzzy systems with neat architecture	04
	(c) Develop a soft computing based solution for intelligent traffic signal control system	07
	OR	
Q.5	(a) What is learning vector quantization?	03
	(b) A genetic algorithm is used to minimize $f(x) = x^2$ in the range $[0, 31]$. If the initial population has a chromosome 10011, explain the steps of fitness evaluation and binary encoding.	04
	(c) Define defuzzification. Explain and compare the first of maxima and last of maxima method.	07
