# Question Bank
# FLA
# CT2

July 2026

1) Describe the Singular Value Decomposition (SVD) method and the Combs Method. Compare their roles in fuzzy systems, particularly in terms of computational efficiency and handling high-dimensional data.

2) Suppose a fuzzy preference relation is given among three alternatives A, B, and C.
$\mu(A,B)=0.7$
$\mu(B,C)=0.8$
$\mu(C,A)=0.6$
Discuss how nontransitive ranking may arise in this case. Construct the ranking order and explain its implications in fuzzy decision-making.

3) Explain how the Combs method helps in reducing the number of rules in a fuzzy inference system. Illustrate with an example for a 2-input fuzzy system, each with 3 fuzzy sets.

4) A transportation company has a fuzzy relation matrix representing the preference levels of drivers for different routes.
(i) Use Singular Value Decomposition (SVD) to reduce this matrix. (ii) Reconstruct the matrix using the top-2 singular values and explain how this simplification preserves the essential information for decision-making.

**5) For an appraisal system in college, the management decides to use Fuzzy Synthetic Evaluation. Explain each component in FSE 1) Factor Set, 2) Evaluation Set, 3) Weight Vector, 4) Fuzzy Relation matrix and 5) Synthetic Evaluation Result for the appraisal system.**

**6) A manufacturing company needs to select the best supplier based on multiple conflicting criteria such as cost, quality, and delivery time.**
**(a) Define fuzzy ordering and explain its significance in multi-objective decision making.**
**(b) Illustrate how fuzzy ordering helps in ranking alternative suppliers when objectives conflict, ensuring a balanced and informed selection.**

7) Explain the need for rule reduction in fuzzy systems. Describe the Singular Value Decomposition (SVD) method and the Combs method for fuzzy rule-base reduction. Compare the two methods with suitable examples, highlighting their advantages and limitations.

8) Discuss the role of fuzzy information in decision making. Explain Preference and Consensus, Multiobjective Decision Making, and Decision Making under Fuzzy States and Fuzzy Actions with appropriate examples. Solve a simple decision-making problem using any one of these techniques.

1) Describe the difference between hard clustering (c-Means) and fuzzy clustering (fuzzy c-Means). Discuss how fuzzy membership values provide more flexibility in real-world data analysis.

2) In a pattern recognition task, an object is represented by two features
Object = [0.4, 0.6]
Class prototypes are given by
Class A = [0.3, 0.7]
Class B = [0.8, 0.2]
Using Euclidean distance, determine the closest class for the object. Explain how multifeature analysis improves recognition accuracy compared to single-feature analysis.

3) Explain how fuzzy logic can be integrated with neural networks for multi-feature pattern recognition, highlighting the advantages, working principles, and potential applications of this hybrid approach.

4) A retail company wants to segment its customers using Fuzzy C-Means (FCM) clustering based on purchasing behavior.
(i) Explain how to determine the optimal number of clusters in FCM for this scenario.
(ii) Discuss the criteria or methods used to ensure meaningful and effective customer segmentation.

**5) Explain how Fuzzy Logic could be used in Handwritten Character Recognition by following the 7 steps: 1) Image Acquisition, 2) Preprocessing, 3) Feature Extraction 4) Fuzzification, 5) Fuzzy Rule base, 6) Inference and 7) Decision Making**

6) Explain the concept of fuzzy classification based on equivalence relations. Discuss Cluster Analysis, Cluster Validity, c-Means Clustering, and Fuzzy c-Means Clustering. Compare c-Means and Fuzzy c-Means with suitable examples.

7) What is a Classification Metric? Explain how Similarity Relations are derived from clustering. Using a suitable numerical example, illustrate the application of Fuzzy c-Means clustering and evaluate the quality of the resulting clusters.

8) Describe the application of fuzzy logic in pattern recognition. Solve a simple fuzzy classification problem and explain the steps involved. Also discuss the case study of handwritten character recognition using fuzzy logic, highlighting its working principle, advantages, and limitations.

UNIT 05

1) Design a simple fuzzy logic controller for a temperature control system with inputs “temperature is low, medium, high” and output “heater power is low, medium, high.” Provide a possible rule base and explain how fuzzification and defuzzification would work in this case

2) Consider a fuzzy optimization problem where two conflicting objectives (cost and quality) must be balanced. Explain step-by-step how fuzzy goals can be formulated and how a solution can be obtained using the max-min approach.

3) Explain how genetic algorithms can be applied to fuzzy optimization problems, highlighting their working principles, advantages, and how they help in finding optimal solutions under uncertainty.

4) Design a basic fuzzy logic controller for a fan speed control system using temperature and humidity as inputs.

**5) Consider a linear programming problem where the coefficients of the objective function and constraints are fuzzy numbers. Describe how fuzzy optimization techniques can be applied to solve such problems. Illustrate the steps involved in the solution process.**

6) Explain the design of a fuzzy control system. Discuss the Control System Design Problem, Control (Decision) Surface, and the assumptions made in designing a fuzzy control system. Illustrate your answer with a simple fuzzy logic controller.

7) Design a fuzzy logic controller for a suitable real-world application. Explain the steps involved in the design process with a neat block diagram. Also discuss the Aircraft Landing Control Problem as an application of fuzzy control systems.

8) Discuss the applications of fuzzy logic in intelligent control systems. Explain the Robot Navigation case study using fuzzy logic, describing its architecture, fuzzy rule base, and decision-making process. Highlight the advantages of fuzzy logic over conventional control methods in autonomous navigation.