**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**MSc DEGREE EXAMINATION MAY 2026**
(Fourth Semester)

Branch - **MATHEMATICS**

**FUZZY SET THEORY**

Time: Three Hours | Maximum: 75 Marks

**SECTION-A (10 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (10 × 1 = 10)

| Question No. | Question | K Level | CO |
|---|---|---|---|
| 1 | Which of the following is a basic operation on fuzzy sets?<br>a) Addition b) Intersection<br>c) Division d) Differentiation | K3 | CO1 |
| 2 | (A ∩B)(x) =<br>a) min[A(x), B(x)], b) max[A(x), B(x)],<br>c) min[A(x)], d) min[B(x)], | K3 | CO1 |
| 3 | If R is a binary relation on a set A, then its inverse $R^{-1}$<br>a) Is not a relation<br>b) Contains elements (b, a) if (a, b) ∈ R<br>c) Is the same as R<br>d) Contains only reflexive pairs | K3 | CO1 |
| 4 | Consider Fuzzy relation R(X, Y), its domain $domR(x)$ =<br>a) $\underset{y\in Y}{max}R(x,y)$ b) $\underset{y\in Y}{min}R(x,y)$<br>c) $\underset{y\in Y}{max}R(y)$ d) $\underset{y\in Y}{min}R(y)$ | K3 | CO1 |
| 5 | The Sugeno fuzzy measure is primarily used in<br>a) Image compression<br>b) Decision making under uncertainty<br>c) Time series analysis<br>d) Graph theory | K3 | CO1 |
| 6 | If A, B are fuzzy set in X then Fuzziness fails when _____.<br>a) $A \cup A^C = X$ b) $A \cup B = B \cup A$<br>c) $A \cap B = B \cap A$ d) $A \leq B$ | K4 | CO3 |
| 7 | Which of the following is NOT a type of uncertainty handled by fuzzy logic?<br>a) Linguistic uncertainty<br>b) Random uncertainty<br>c) Measurement uncertainty<br>d) Probabilistic uncertainty | K3 | CO3 |
| 8 | In fuzzy logic, uncertainty is primarily represented using<br>a) Probability distributions<br>b) Membership functions<br>c) Crisp sets<br>d) Binary values | K4 | CO4 |
| 9 | What is the main advantage of using fuzzy MCDM in environmental management?<br>a) It eliminates all subjectivity<br>b) It handles uncertainty and vagueness in human judgment<br>c) It replaces expert judgment entirely<br>d) It is only based on quantitative data | K3 | CO4 |
| 10 | In fuzzy decision-making, a membership function is used to<br>a) Assign probabilities<br>b) Define binary categories<br>c) Measure degrees of truth<br>d) Rank alternatives strictly | K3 | CO4 |

**Cont...**

## SECTION - B (35 Marks)

Answer **ALL** questions

**ALL** questions carry **EQUAL** Marks (5 × 7 = 35)

| Question No. | Question | K Level | CO |
|---|---|---|---|
| 11.a. | Prove that every fuzzy complement has at most one equilibrium. | K3 | CO1 |
| | (OR) | | |
| 11.b. | Explain Algebraic operation of fuzzy sets. | K4 | |
| 12.a. | Explain about crisp relation and fuzzy relation. | K1 | CO2 |
| | (OR) | | |
| 12.b. | Explain about Binary relations on a single set. | K5 | |
| 13.a. | Explain about belief and Plausibility measure. | K1 | CO3 |
| | (OR) | | |
| 13.b. | Describe properties of Sugeno 's measure. | K5 | |
| 14.a. | Clarify about the Type of Available Information. | K4 | CO4 |
| | (OR) | | |
| 14.b. | Explain about Matching Uncertainty Theory and Uncertain Phenomena. | | |
| 15.a. | Explain about Multi Objective Decision Making (MODM). | K1 | CO5 |
| | (OR) | | |
| 15.b. | Classify about Fuzzy Dynamic Programming. | | |

## SECTION -C (30 Marks)

Answer **ANY THREE** questions

**ALL** questions carry **EQUAL** Marks (3 × 10 = 30)

| Question No. | Question | K Level | CO |
|---|---|---|---|
| 16 | Describe about fuzzy union operations. | K2 | CO1 |
| 17 | Explain about fuzzy compatibility relations. | K3 | CO2 |
| 18 | Classify relationship among classes of fuzzy measure. | K4 | CO3 |
| 19 | Explain about measures of uncertainty. | K5 | CO4 |
| 20 | Let $\tilde{d}_1$ $\check{d}_2$ be the two decision variables, the possible values of which can be $\alpha_1, \alpha_2$. The state variables are $x_t = 0, \ldots, 2$ with a finite range $X = \{\tau_1, \tau_2, \tau_3\}$. The fuzzy constraints for $t$ =0 and $t$ =1 are $\check{C}_0\alpha_i = (\alpha_1, 0.7), (\alpha_2, 0.7)$ $\check{C}_1\alpha_i = (\alpha_1, 1), (\alpha_2, 0.6)$ The fuzzy goal is specified as $\check{G}_1x_2 = (\tau_1, 0.3), (\tau_2, 1), (\tau_3, 0.8), (\alpha_2, 0.6)$ and the crisp transformation function is defined by the following matrix. | K5 | CO5 |

| | $x_i$ | | |
|---|---|---|---|
| $d_t$ | $\tau_1$ | $\tau_2$ | $\tau_3$ |
| $\alpha_1$ | $\tau_1$ | $\tau_3$ | $\tau_1$ |
| $\alpha_2$ | $\tau_2$ | $\tau_1$ | $\tau_3$ |

Construct the crisp transformation function and its matrix.

Z-Z-Z END