ages) **Reg. No. :** ....

ode No. : 30366 E **Sub. Code : SEMA 6 B**

(CBCS) DEGREE EXAMINATION, APRIL 2022.

Sixth Semester

Mathematics

Major Elective — FUZZY MATHEMATICS

(For those who joined in July 2017 onwards)

me : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

Which of the following symbol is used for the existential quantifier?

(a) $\forall$ (b) $\exists$

(c) iff (d) α

$\alpha_A = \{x / A(x) \geq \alpha\}$ is

(a) strong α-cut (b) α-cut

(c) crisp set (d) fuzzy set

3. Let $A, B, \in \mathcal{F}(x)$ and $\alpha, \beta \in [0, 1]$, then $\alpha \leq \beta \Rightarrow$

(a) $\alpha_A = \beta_A$ (b) $\alpha_A \supseteq \beta_A$

(c) $\alpha_A \subseteq \beta_A$ (d) None

4. Third decomposition theorem states

(a) $A = \bigcup_{\alpha \in A(A)} \alpha A$ (b) $A = \bigcup_{\alpha \in [0,1]} \alpha A$

(c) $A = \bigcup_{\alpha \in [0,1]} \alpha + A$ (d) None

5. The value of $(A \cap B)x =$

(a) $\max[A(x), B(x)]$

(b) $\min[A(x), B(x)]$

(c) $\max[\overline{A}(x), \overline{B}(x)]$

(d) $\min[\overline{A}(x), \overline{B}(x)]$

6. The value of $c(A(x))$

(a) $A\,c(x)$

(b) $A\ c((x))$

(c) $c\,A(x)$

(d) None

$A \subseteq E$ and $B \subseteq F$ then

) $A + B \subseteq E + F$

) $A + E \subseteq B + F$

) $E + F \subseteq A + B$

) $A + F \subseteq B + E$

he value of MIN$[A, \text{MAX}(A, B)]$

) MAX (A, B)

) MIN(A, B)

) A

) None

fuzzy model group decision was proposed by

) Bellman (b) Blin

) Robert (d) Dantzig

fuzzy decision making was introduced at

) 1970 (b) 1977

) 1980 (d) 1972

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Write any ten fundamental properties of crisp set operations.

Or

(b) Define the following with example.

(i) crisp set

(ii) fuzzy set.

12. (a) Let $A, B \in \mathcal{F}(x)$ and $\alpha, \beta \in [0, 1]$ then prove that $\alpha(\overline{A}) = (1 - \alpha) + \overline{A}$.

Or

(b) Let $f : x \to y$ be an arbitrary crisp function. Then for any $A \in \mathcal{F}(x)$ and all $\alpha \in [0, 1]$, prove that $\alpha + [f(A)] = f(\alpha + A)$.

13. (a) If a complement c has an equilibrium e_c, then prove that $d_{e_c} = e_{\bar{c}}$.

Or

(b) Prove that the standard fuzzy intersection is the only idempotent t-norm.

[P.T.O.]

14. (a) Write a short note on fuzzy numbers.

Or

(b) Explain the fuzzy equations.

15. (a) Explain the individual decision making.

Or

(b) Explain the fuzzy linear programming.

PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

16. (a) Explain the crisp sets in detail.

Or

(b) Prove that a fuzzy set A on R is convex iff $A(\lambda x_1 + (1-\lambda)x_2) \geq \min[A(x_1), A(x_2)]$ for all $x_1, x_2 \in R$ and all $\lambda \in [0, 1]$.

17. (a) Let $A_i \in \mathcal{F}(x)$ for all $i \in I$. Then prove that

$$\bigcup_{i\in I} \alpha + A_i = \alpha + \left(\bigcup_{i\in I} A_i\right) \text{ and}$$

$$\bigcap_{i\in I} \alpha + A_i \subseteq \alpha + \left(\bigcap_{i=I} A_i\right).$$

Or

(b) State and prove first decomposition theorem.

18. (a) State and prove second characterization theorem of fuzzy complements.

Or

(b) For all $a, b \in [0, 1]$ then prove that $i_{\min}(a, b) \leq i(a, b) \leq \min(a, b)$.

19. (a) For any $A, B, C \in R$ prove that $\text{MIN}[\text{MIN}(A, B), C] = \text{MIN}[A, \text{MIN}(B, C)]$.

Or

(b) Let $A \in \{+, -, \cdot, /\}$ and let A, B denote continuous fuzzy numbers, then prove that the fuzzy set $A * B$ defined by $(A * B)(z) = \sup_{z=x+y} \min[A(x), B(y)]$ is a continuous fuzzy number.

20. (a) Explain the multi person decision making.

Or

(b) Solve the fuzzy linear programming problem.

$$\max = z = 5x_1 + 4x_2$$

$$s.t. (4, 2, 1)x_1 + (5, 3, 1)x_2 \leq (24, 5, 8)$$

$$(4, 1, 2)x_1 + (1, .5, 1)x_2 \leq (12, 6, 3)$$

$$x_1, x_2 \geq 0.$$