(7 pages) **Reg. No. :** ....

Code No. : 30369 E **Sub. Code : JMMA 6 A**

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2020.

Sixth Semester

Mathematics –Main

Major Elective-III — FUZZY MATHEMATICS

(For those who joined in July 2016 only)

Time : Three hours Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. The family of all subsets of a given set A is called the ————.

   (a) power set of A

   (b) relative complement of A

   (c) characteristic function of A

   (d) none

2. A family of pairwise disjoint non empty subsets of a set A is called ————.

(a) a partition of A

(b) cartesian product of A

(c) nested family

(d) none of these

3. For $A \in \mathfrak{F}(x)$ ————.

(a) ${}^{\alpha}A = {}^{\alpha} \bigcap A$ (b) ${}^{\alpha}A = {}^{\alpha+} A$

(c) ${}^{\alpha}A = \bigcap_{\beta < \alpha} {}^{\beta}A$ (d) ${}^{\alpha}A = \bigcup_{\beta < \alpha} {}^{\beta}A$

4. Let $f : X \to Y$ be an arbitrary crisp function then for any $A_i \in \mathfrak{F}(X), i \in I$ and $B_i \in \mathfrak{F}(X)$ if $B_1 \leq B_2$ then ————.

(a) $f^{-1}(B_1) \subseteq f^{-1}(B_2)$

(b) $f^{-1}(B_1) \supseteq f^{-1}(B_2)$

(c) $f^{-1}(B_1) = f^{-1}(B_2)$

(d) $f^{-1}(B_1) \subset f^{-1}(B_2)$

5. For any $A, B \in \mathbb{R}$, $A \leq B$, ————.

(a) ${}^{\alpha}A \leq {}^{\alpha}B$ (b) ${}^{\alpha}A < {}^{\alpha}B$

(c) ${}^{\alpha}A = {}^{\alpha}B$ (d) None

6. Every fuzzy complement has ————.

(a) atmost one equilibrium

(b) atleast one equilibrium

(c) equal to one equilibrium

(d) none

7. If $W = \langle .3, .1, .2, .4 \rangle$ then $h_w(.6, .9, .2, .7) =$

(a) .54 (b) 5.4

(c) 45 (d) 4.5

8. If $A = [2, 5], B = [1, 3]$ then $A + B =$ ————.

(a) [3, 8] (b) [5, 6]

(c) [7, 4] (d) [2, 15]

9. For each vector $X = \langle x_1, x_2, ..., x_n \rangle$, the degree is denoted by ————.

(a) $D_i(X)$ (b) $d_i(X)$

(c) $B_i(X)$ (d) $Z_i(X)$

10. $S(x_i, x_j) =$ ————————.

(a) $\dfrac{N(x_i, x_j)}{n}$ (b) $N(x_i, x_j)\, n$

(c) $N(x_i, x_j)$ (d) $\dfrac{N(x_i, x_j)}{2n}$

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Describe the concept of fuzzy set.

Or

(b) Define convex set. Give an example of convex set and non convex set.

12. (a) Let $A, B \in \mathfrak{F}(X)$, then prove that ${}^{\alpha}(A \cup B) = {}^{\alpha}A \cup {}^{\alpha}B$ for all $\alpha, \beta \in [0, 1]$.

Or

(b) Let $f : X \to Y$ be a arbitrary function then prove that for any $A \in \mathfrak{F}(X)$, f fuzzified by the extension principle satisfies the equation $f(A) = \bigcup_{\alpha \in [0,1]} f({}_{\alpha+}A)$.

13. (a) State first and second characterization theorem of fuzzy complements.

Or

(b) Prove that $i_{\min}(a, b) \le i_w(a, b) \le \min(a, b)$.

14. (a) Define four arithmetic operations in a closed intervals.

Or

(b) If $A(x) = \begin{cases} 0, & for\ x \le -1\ and\ x > 3 \\ \frac{x+1}{2}, & for\ -1 < x \le 1 \\ \frac{3-x}{2}, & for\ 1 < x \le 3 \end{cases}$ and

$$B(x) = \begin{cases} 0, & for\ x \le 1\ and\ x > 5 \\ \frac{x-1}{2}, & for\ 1 < x \le 3 \\ \frac{5-x}{2} & for\ 3 < x \le 5 \end{cases}$$

find their α-cuts.

15. (a) Define fuzzy linear programming problem.

Or

(b) Solve the following by graphical method

Min $Z = x_1 - 2x_2$

subject to $3x_1 - x_2 \ge 1$,

$2x_1 + x_2 \le 6$,

$0 \le x_2 \le 2$,

$0 \le x_1$

PART C — ($5 \times 8 = 40$ marks)

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

Each answer should not exceed 600 words.

16. (a) Write any eight fundamental properties of crisp set operations.

Or

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

17. (a) Let $f : X \to Y$ be an arbitrary crisp function. Then for any $A \in \mathfrak{F}(X), f$ fuzzified by the extension principle satisfies the equation ${}^{\alpha+}[f(A)] = f({}^{\alpha+}A)$.

Or

(b) Let $A, B \in \mathfrak{F}(X)$, then prove that ${}^{\alpha}(A \cap B) = {}^{\alpha}A \cap {}^{\alpha}B$.

18. (a) Prove that $\langle i, u, c \rangle$ satisfies the law of excluded middle and the law of contradiction.

Or

(b) Prove that if c is a continuous fuzzy complement then c has a unique equilibrium.

19. (a) Prove that $MIN(A, B) = MIN(B, A)$ and $MAX(A, B) = MAX(B, A)$.

Or

(b) Explain about fuzzy equations.

20. (a) Explain about multiperson decision making.

Or

(b) Explain about individual decision making.