Reg. No………………………………………….. Name…………………………………………… **19U541**

B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2019

SEMESTER **–5: MATHEMATICS (CORE COURSE)**

COURSE: **15U5CRMAT8: FUZZY MATHEMATICS**

(Common for Regular 2017 Admission & Improvement 2016/Supplementary 2016/2015 Admissions)

Time: Three Hours Max. Marks: 75

PART A

Answer All questions. Each Question carries 1 Mark.

1. Define partition of a set.
2. Define interval valued fuzzy sets.
3. Compute the scalar cardinality of the fuzzy set A defined by A(x) = $\frac{x}{x+2}$, x ∈ {0,1,2,3,4}
4. Write the axiomatic skeleton for fuzzy complements.
5. Give example of an idempotent t-norm.
6. State the membership function of drastic union.
7. Express an ordinary real number in the format of a fuzzy number.
8. Find [2,5] – [1,3]
9. Write the scheme of generalized modus ponens.
10. Write the set of truth values of an n-valued logical system. (1 x 10 = 10)

PART B

Answer any eight questions. Each question carries 2 marks

11. Define α-cut of a fuzzy set. Find the α-cut of the fuzzy set A defined by A(x) = $\frac{x}{x+1}$, x∈ $[0, 10]$.
12. For A, B ∈ $\mathcal{F}$ (X) and α ∈ [0,1], prove that $^{\alpha}(A \cap B) = {}^{\alpha}A \cap {}^{\alpha}B$
13. Show that law of contradiction is not true for a fuzzy set.
14. Show that the Sugeno class of fuzzy complements is involutive.
15. State the characterization theorem of t-norms.
16. State the axiomatic skeleton for fuzzy unions.
17. Verify that the fuzzy set A(x) = $\left\{ \begin{array}{cc} \sin x & 0 \le x \le \pi \\ 0 & otherwise \end{array} \right\}$ is a fuzzy number.
18. Give an example to show that distributivity does not hold in general for arithmetic operations on closed intervals.
19. Define a Boolean algebra.
20. Define quasi-tautology. (2 x 8 = 16)

PART C

Answer any five questions. Each question carries 5 marks

21. Prove that a fuzzy set on R is convex iff A [$\lambda x_1 + (1-\lambda)x_2$] ≥ min [A(x_1), A (x_2)], for all x_1 , $x_2 \in R$ and λ ∈ [0,1].
22. State and prove first decomposition theorem.

23. For A, B ∈ Ƒ (X), prove that ${}^{\alpha}(\bar{A}) = {}^{(1-\alpha)+}\bar{A}$
24. Prove that every fuzzy complement has atmost one equilibrium.
25. Prove that for all a, b ∈ [0,1], i_{min}(a, b) ≤ i (a,b) ≤ min(a,b)
26. For the two fuzzy numbers,

$$A(x) = \begin{cases} 0 & x \leq -1 \text{ and } x > 3 \\ \frac{x+1}{2} & -1 < x \leq 1 \\ \frac{3-x}{2} & 1 < x \leq 3 \end{cases}$$

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

Find ${}^{\alpha}$(A+B) and ${}^{\alpha}$(A-B).

27. Explain linguistic hedges. (5 x 5 = 25)

PART D

Answer any two questions. Each question carries 12 marks

28. (a) Define a t-conorm and state all the seven axioms.
    (b) Prove that standard fuzzy union is the only idempotent t-conorm.
29. Define a dual triple. Show that the triples (min, max, c) and (i_{min}, U_{max}, C) are dual triples with respect to any fuzzy complement C.
30. For A∈ Ƒ (R), state and prove the necessary conditions for A to be a fuzzy number.
31. Describe about the four types of fuzzy propositions. (12 x 2 = 24)

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