Reg. No……………………………………………. Name……………………………………………

B.Sc. DEGREE END SEMESTER EXAMINATION OCTOBER 2017

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

COURSE: **15U5CRMAT8: FUZZY MATHEMATICS**

(For Regular 2015 admission)

Time: Three Hours Max. Marks: 75

PART A

Answer **all** questions. Each question carries 1 mark

1. Distinguish between randomness and fuzziness.
2. Define type 2 fuzzy sets.
3. Compute Scalar cardinality of the fuzzy set define by the membership function $C(x) = \frac{x}{x+1}$ for $x \in X = \{0,1,\dots,10\}$
4. What is an axiomatic skeleton for fuzzy complements?
5. Explain algebraic sum and show that it is a t co-norm.
6. Discuss decreasing generators of a fuzzy complement.
7. Give one example for a fuzzy number.
8. Evaluate $[-1,1]/[-2,-0.5]$
9. Define a Boolean algebra.
10. Distinguish between binary and multivalued logics. (1 x 10 = 10)

PART B

Answer **any Eight** questions. Each question carries 2 marks

11. Show that $\alpha(A \cap B) = \alpha A \cap \alpha B$
12. Show by an example that law of contradiction and law of excluded middle are not true for fuzzy sets.
13. State and prove any one of De Morgan's Laws for fuzzy sets.
14. Define an involutive fuzzy complements. Give an example.
15. Show that $i(a,b) \leq \min(a,b)$ for any t norm i.
16. State characterization theorem for t-conorms.
17. Prove that $A.(B+C) \subseteq A.B + A.C$ where A, B and C are any closed intervals.
18. Define MIN and MAX operation on fuzzy numbers.
19. Define linguistic hedges.
20. Give the expression for generalized modus tollens. (2 x 8 = 16)

PARTC

Answer **any Five** questions. Each question carries 5 marks

21. Define Extension principle and explain with an example.
22. $X = [0,10], A(x) = \frac{x}{x+2}, B(x) = 2^{-x}$, Draw the graph of these membership functions and also draw the graph of the membership function of $A \cup B$.

23. Prove that every fuzzy complement has at most one equilibrium.
24. If f is a decreasing generator , then prove that the function $g(a) = f(0) - f(a), for\ all\ a \in [0,1]$ is an increasing generator with $g(1) = f(0)$
25. Prove that $MIN[A, MAX(A, B)] = A$
26. Explain the procedure to solve the equation $A + X = B$ where A and B are given fuzzy numbers.
27. $X = \{x1, x2, x3\}, Y = \{y1, y2\}, A = \left\{\frac{.5}{x1} + \frac{1}{x2} + \frac{.6}{x3}\right\}, B = \left\{\frac{1}{y1} + \frac{.4}{y2}\right\}, and$ R is the Lukasiewicz implication. Assume the proposition "If $x\ is\ A, then\ y\ is\ B$" . Given a fact $y\ is\ B'$ where $B' = \left\{\frac{.9}{y1} + \frac{.7}{y2}\right\}$ then evaluate A' for the inference of the form $x\ is\ A'$. (5 x 5 = 25)

PART D

Answer **any Two** questions. Each question carries 12 marks

28. State and prove first decomposition theorem.
29. Given a t norm i and an involutive fuzzy complement c. Prove that the binary operation defined as $u(a, b) = c(i(c(a), c(b)))$ for all $a, b \in [0,1]$ is a t conorm such that $< i, u, c >$ is a dual triple.
30. Show that (R, MIN, MAX) is a distributive lattice.
31. Discuss the four types of fuzzy propositions. (12 x 2 = 24)

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