Reg. No……………………….……………….   Name……………………………………………   **18U541**

B.Sc. DEGREE END SEMESTER EXAMINATION OCTOBER/NOVEMBER 2018

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

COURSE: **15U5CRMAT8: FUZZY MATHEMATICS**

(Common for Regular 2016 admission & Supplementary 2015 admission)

Time: Three Hours   Max. Marks: 75

PART A

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

1. Define characteristics function of a crisp set and membership function of a fuzzy set.
2. Discuss level 2 fuzzy sets.
3. Explain subset hood of a fuzzy set in another fuzzy set.
4. What is an axiomatic skeleton for t-norms.
5. Does there exist discontinuous fuzzy complements. Justify your answer.
6. Define a dual triple.
7. What are fuzzy numbers?
8. How can we define a product of two closed intervals?
9. Discuss Tautology and contradiction.
10. Explain Existential and universal quantifiers. (1 x 10 = 10)

PART B

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

11. Define ∝-cuts and strong ∝-cuts of a fuzzy set. Also show that $\alpha^{+}A \subseteq \propto A$.
12. $C(x) = \frac{x}{x+1}, D(x) = 1 - \frac{x}{10}, x \in X = \{0,1, \dots ,10\}$. Evaluate $C \cap D$ and $C \cup D$.
13. Prove that $A \subseteq B\ iff\ \propto A \subseteq \propto B$
14. Show that sugeno class of complements are involutive.
15. Define a dual triple. Show that <min, max, c>is a dual triple for any fuzzy complement c.
16. Give an example of a t conorm and show that it satisfy the axiomatic skeleton for t-conorms.
17. Give the four arithmetic operations on closed intervals.
18. If A and B are any two fuzzy numbers, then give an expression for the membership function of $A + B$.
19. Define generalized modus ponens.
20. What is meant by generalized hypothetical syllogism? (2 x 8 = 16)

PART C

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

21. $X = [0,10],\ A(x) = \frac{x}{x+2}, B(x) = 2^{-x}$, Draw the graph of these membership functions and also draw the graph of the membership function of $A \cap B$.

22. Explain height and support of a fuzzy set with examples.
23. Define equilibrium point of a fuzzy complement and dual point of a value between 0 and 1 with respect to a fuzzy complement. Show that if a fuzzy complement has an equilibrium point then the dual point of that equilibrium is itself.
24. Prove that standard fuzzy intersection is the only idempotent t norm.
25. Prove that $MIN(MIN(A,B),C) = MIN(A, MIN(B,C))$
26. Define a partial order on the set of fuzzy numbers on R. Also define a partial order in terms of $\propto$-cuts
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 $x\ is\ A'$ where $A' = \left\{\frac{.6}{x1} + \frac{0.9}{x2} + \frac{.7}{x3}\right\}$ then evaluate B' for the inference of the form $y\ is\ B'$. (5 x 5 = 25)

PART D

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

28. Define a convex fuzzy set. State and prove the necessary and sufficient condition for a fuzzy set on **R** to be convex.
29. Let c is any involutive fuzzy complement and g is an increasing generator of c, then prove that t norm i and t conorm u generated by g are dual with respect to c. Also prove that $< i, u, c >$ satisfy law of excluded middle and law of contradiction.
30. State and prove the necessary and sufficient condition for a fuzzy set A on R to be a fuzzy number
31. Explain the three procedures to make inference from fuzzy propositional quantifiers.

(12 x 2 = 24)

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