Reg. No............................ Name..................................... U535

B.SC. DEGREE END SEMESTER EXAMINATION OCTOBER 2016

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

COURSE: **U5CRMAT8 – FUZZY MATHEMATICS**

Time: Three Hours Max. Marks: 75

SECTION A

*Answer **all** questions*

1. Define a fuzzy set.
2. Define the scalar cardinality of a fuzzy set
3. Define cut worthy property
4. Give an example of a fuzzy complement
5. State second characterization theorem of fuzzy complements.
6. Give the pseudo-inverse of an increasing generator g
7. Define the Archimedean t-norm
8. Define the product [a, b].[c, d]
9. Write the canonical form of an unconditional and qualified proposition
10. Define the primitive a ⇒ b according to Lukasiewicz

(1 x 10 = 10)

SECTION B

*Answer **any eight***

11. For A ε F(X) and α ε [0,1], Show that , $^{\alpha}(\acute{A}) = {}^{(1-\alpha)+}(\acute{A})$
12. Prove that a continuous fuzzy complement has a unique equilibrium
13. Let A, B ε F(X) and f: X→Y be an arbitrary crisp function. Prove by extension principle that A ⊆ B then f(A) ⊆ f(B)
14. Prove that i(a, b) ≤ min (a, b) for ay t-norm i
15. Prove that any real umber and any closed interval are fuzzy numbers
16. State the characterization theorem of t-norms
17. Show that standard fuzzy union is the only idempotent t-conorm.
18. Define linguistic Hedges with an example
19. Show that X=B-A is not the solution of the fuzzy equation A+X=B.
20. Define the fuzzy numbers MIN(A,B) and MAX(A,B) where A and B are fuzzy numbers

(2 x 8 = 16)

SECTION C

Answer ***any five***

21. Let A_i ε F(X) for all i ε I, where I is an index set. Prove that ¿$i \in I$¿¿ and that $\cap_{i \varepsilon I}$¿.
22. State and prove the first decomposition of theorem of fuzzy sets.
23. Show that the triples < i_{min}, u_{max}, c > are dual with respect to any fuzzy complement c
24. Prove that the algebraic product i(a, b) = ab, where a. b ε [0, 1] is a t-norm

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

26. Given an involute fuzzy complement c and an increasing generator g of c, prove that t-norm and
t-conorm generated by g are duel with respect to c.

27. Explain unconditional and unqualified propositions.

(5 x 5 = 25)

SECTION D

Answer ***any two***

28. (i) Prove that c : [0,1) →[0,1] defined by c(a) = $\begin{cases} 1, for\ a \leq t \\ 0, for\ a > t \end{cases}$, is not continuous and involutive

(ii) Define the Sugeno Class of fuzzy complements and prove that it is involutive

(iii) Define a decreasing generator *f* and its pseudo inverse $f^{(-1)}$. Also define their compositions
$f_0 f^{(-1)}$ and $f^{(-1)}{}_o\, f$

29. State and prove the necessary and sufficient condition for a fuzzy set A defined on R to be a
fuzzy number.

30. What are fuzzy quantifiers? Explain the two kinds of fuzzy quantifiers with examples

31. Explain the three inference rules with examples

(12 x 2 = 24)

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