



**THE AMERICAN COLLEGE, MADURAI**  
AN AUTONOMOUS INSTITUTION AFFILIATED TO MADURAI KAMARAJ  
UNIVERSITY

Re-accredited (2<sup>nd</sup> Cycle) by NAAC with Grade “A”, CGPA – 3.46 on a 4-point scale

**Backlog Arrear Examination, March 2021**

**Course : Fuzzy Mathematics**

**Marks: 75**

**Course Code : MAT /MAS 3512 /3546**

**Time : 3 hrs**

**Answer any 5 out of 7 :**

**( 5 X 15 = 75)**

1. State and prove decomposition Theorems of Fuzzy sets.
2. let  $f : X \rightarrow Y$  be an arbitrary crisp function then for any  $A_i \in \mathcal{F}(Y), i \in I$  the following properties of functions obtained by the extension principle holds :
  - (i)  $f(A) = \varphi$  iff  $A = \varphi$
  - (ii) If  $A_1 \subseteq A_2$  then  $f(A_1) \subseteq f(A_2)$
  - (iii)  $f(\cup_{i \in I} A_i) = \cup_{i \in I} f(A_i)$
  - (iv)  $f(\cap_{i \in I} A_i) = \cap_{i \in I} f(A_i)$
  - (v) If  $B_1 \subseteq B_2$  then  $f^{-1}(B_1) \subseteq f^{-1}(B_2)$
  - (vi)  $f^{-1}(\cup_{i \in I} B_i) = \cup_{i \in I} f^{-1}(B_i)$
  - (vii)  $f^{-1}(\cap_{i \in I} B_i) = \cap_{i \in I} f^{-1}(B_i)$
  - (viii)  $\overline{f^{-1}(B)} = f^{-1}(\overline{B})$
  - (ix)  $A \subseteq f^{-1}(f(A))$
  - (X)  $B \subseteq f(f^{-1}(A))$
3. (a) Prove that For all  $a, b \in [0, 1], \max(a, b) \leq u(a, b) \leq u_{\max}(a, b)$   
(b) Prove that For all  $a, b \in [0, 1], \min(a, b) \geq i(a, b) \geq i_{\min}(a, b)$
4. Let  $* \in \{+, -, \cdot, /\}$  and let  $A, B$  denote the continuous fuzzy numbers. Then the fuzzy set  $A * B(z) = \sup_{z \in x * y} \min[A(x), B(x)]$  is a continuous fuzzy number.
5. Write the transitive algorithm and using this, Find the transitive closure of the relation,

$$R = \begin{bmatrix} 0.7 & 0.5 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0.4 & 0 & 0 \\ 0 & 0 & 0.8 & 0 \end{bmatrix}$$

6. If

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

and

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

Find  $A+B$ ,  $A-B$ ,  $A.B$ ,  $A/B$

7. Solve the fuzzy relation equation,

$$p = \begin{pmatrix} .1 & .4 & .5 & .1 \\ .9 & .7 & .2 & 0 \\ .8 & 1 & .5 & 0 \\ .1 & .3 & .6 & 0 \end{pmatrix} \quad \& \quad r = [.8 \ .7 \ .5 \ 0]$$

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