Sanjay Ghodawat University, Kolhapur

2020-21

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

EXM/P/09/00

Year and Program: **S.Y. M. Sc.**	**School of Science**	**Department:** **Mathematics**
Course Code: MTS609.3	**Course Title: Fuzzy Mathematics**	**Semester : III**
Day : Wednesday **Date: 23/12/2020**	**End Semester Examination**	**Time:2 Hrs.** **Max Marks:50**

Instructions: 1) All Questions are compulsory.
2) Use of non-programmable calculator is allowed

Q.1 **Answer the following (any Two)** **Marks** **Bloom's Level** **CO**

a) Show that a fuzzy set $A : R \to [0,1]$ is convex if and only if $A\left[\lambda x_1 + (1-\lambda)x_2\right] \geq \min\left[A(x_1), A(x_2)\right]$, $\forall x_1, x_2 \in$ and all $\lambda \in [0,1]$ where $\min$ denotes the minimum operator. 8 L2 CO1

b) If A and B are fuzzy sets defined on $X = \{x_1, x_2, x_3, x_4, x_5\}$ by $A(x) = \frac{0.1}{x_1} + \frac{0.7}{x_3} + \frac{0.9}{x_4} + \frac{1}{x_5}$ and $B(x) = \frac{0.2}{x_1} + \frac{0.1}{x_2} + \frac{0.6}{x_3} + \frac{1}{x_4} + \frac{0.5}{x_5}$ Find $\overline{A}, \overline{B}, A \cup B, A \cap B, \overline{A} \cup \overline{B}, \overline{A} \cap \overline{B}, \overline{A \cup B}, \overline{A \cap B}, A \cup \overline{A}$, and $A \cap \overline{A}$. 8 L4 CO1

c) Let $A_i \in \Im(X)$ for all $i \in I$,where I as an index set then show that 8 L3 CO2

i) $\bigcup_{i \in I}{}^{\alpha} A_i \subseteq {}^{\alpha}\left(\bigcup_{i \in I} A_i\right)$ and $\bigcap_{i \in I}{}^{\alpha} A_i = {}^{\alpha}\left(\bigcap_{i \in I} A_i\right)$

ii) $\bigcup_{i \in I}{}^{\alpha+} A_i = {}^{\alpha+}\left(\bigcup_{i \in I} A_i\right)$ and $\bigcap_{i \in I}{}^{\alpha+} A_i \subseteq {}^{\alpha+}\left(\bigcap_{i \in I} A_i\right)$

Q.2 **Answer the following (any two)**

a) Let A and B are fuzzy sets defined on universal set $X = Z$ whose membership grades $A(x) = \frac{0.5}{-1} + \frac{1}{0} + \frac{0.5}{1} + \frac{0.3}{2}$, $B(x) = \frac{0.5}{2} + \frac{1}{3} + \frac{0.5}{4} + \frac{0.3}{5}$ .Let $f : Z \times Z \to Z$ be defined for all $\forall x_1, x_2 \in X$ by $f(x_1, x_2) = x_1 + x_2$ then calculate $f(A, B)$. 08 L3 CO2

b) Show that the standard intersection is the only t-norm, which is idempotent. 08 L3 CO3

c) Let $f_p : [0,1] \to R$ defined by $f_p = 1 - a^p$, $p > 0$. Show that f_p is a decreasing generator, also find it's pseudo inverse and obtain t-norm generated by f_p. 08 L4 CO3

Q.3 Answer the following (any two)

a) Show that $g_w(a) = a^w$, $w > 0$ is an increasing generator, and also prove that it generates a Yager's class of t-norm. 09 L4 CO4

b) i) Show that $\langle \min, \max, C_\lambda \rangle$ is a dual triple. 04 L3 CO4

ii) Let $A = [1, 2]$ and $B = [4, 6]$. Prepare $A + B$, $A - B$, $A.B$, A / B, A^{-1}, and B^{-1}. 05 L6 CO5

c) Evaluate X for the fuzzy equation $A.X = B$ for fuzzy numbers defined by membership grade function, 09 L5 CO5

$$A(x) = \begin{cases} 0 & ; x \le 3, \& \; x > 5 \\ x - 3 & ; 3 < x \le 4 \\ 5 - x & ; 4 < x \le 5 \end{cases} \quad \text{and} \quad B(x) = \begin{cases} 0 & ; x \le 12, \& \; x > 32 \\ \dfrac{x - 12}{8} & ; 12 < x \le 20 \\ \dfrac{32 - x}{12} & ; 20 < x \le 32 \end{cases}$$

*****