STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086

(For candidates admitted from the academic year 2019-20 & thereafter)

SUBJECT CODE : 19MT/PE/FT15

M. Sc. DEGREE EXAMINATION, APRIL 2022
BRANCH I – MATHEMATICS
SECOND SEMESTER

COURSE: ELECTIVE
PAPER: FUZZY SET THEORY AND APPLICATIONS
TIME: 3HOURS **MAX MARKS: 100**

SECTION – A

ANSWER ANY <u>FIVE</u> QUESTIONS ONLY: **(5 ×2 = 10)**

1. Obtain the α-cut of the fuzzy set $A(x)=\begin{cases}\frac{(x-25)}{50}, x\in[25,75]\\ \frac{(100-x)}{25}, x\in[75,100]\\ 0\ ,\ elsewhere\end{cases}$.

2. Compute: ${}^{\alpha}\left(\overline{A}\right)$, $\overline{{}^{\alpha}A}$

3. If $c(a)=\frac{1}{2}(1+\cos\pi a)$ is a fuzzy complement, show that it is not involutive.

4. Using Extension principle, define a fuzzy function & its inverse for fuzzy sets.

5. Cite a use of fuzzy relation.

SECTION – B

ANSWER ANY <u>FIVE</u> QUESTIONS ONLY: **(5 × 6= 30)**

6. Derive a necessary and sufficient condition for a fuzzy set to be convex.

7. Write the features that are responsible for the Paradigm shift from the classical set theory.

8. Prove $A\subseteq B$ iff ${}^{\alpha}(A)\subseteq {}^{\alpha}B$ and $A\subseteq B$ iff ${}^{\alpha+}(A)\subseteq {}^{\alpha+}B$

9. Write a note on the use Linguistic variables in fuzzy set theory.

10. Show that: $\lim_{w \to \infty} \min\left[1, \left(a^w + b^w\right)^{\frac{1}{w}}\right] = \max(a,b)$.

11. Explain Fuzzy Binary Relation.

12. Describe the mathematics of fuzzy controller.

SECTION – C

ANSWER ANY <u>THREE</u> QUESTIONS ONLY: (3 × 20 = 60)

13. a) Write about the different types of fuzzy sets.
    b) Show that the extension principle is strong cutworthy but not cutworthy.
    (10+10)

14. a) If $A(x) = \begin{cases} \frac{(x-25)}{50}, x \in [25,75] \\ \frac{(100-x)}{25}, x \in [75,100] \\ 0 \text{ , } elsewhere \end{cases}$ and $B(x) = \begin{cases} \frac{x}{25}, x \in [0,25] \\ \frac{(75-x)}{50}, x \in [25,75] \\ 0 \text{ , } elsewhere \end{cases}$

    Solve the fuzzy equation $X + A = B$.
    b) Define Fuzzy relational equation and solve the same by decomposing.
    (10+10)

15. a) State the conditions required for a function to define fuzzy complement. Discuss the same for Sugeno's class. Find the equilibrium points.
    b) Discuss Yager class of functions to describe fuzzy *union* defining the same. Also check what happens when $\omega \to \infty$. (10+10)

16. a) Derive a necessary and sufficient condition for functions to be membership functions of fuzzy numbers.
    b) When does the fuzzy complement has a unique equilibrium. (10+10)

17. a) Discuss the application Fuzzy Mathematics in Industry.
    b) Discuss the application Fuzzy Mathematics in Medicine. (10+10)