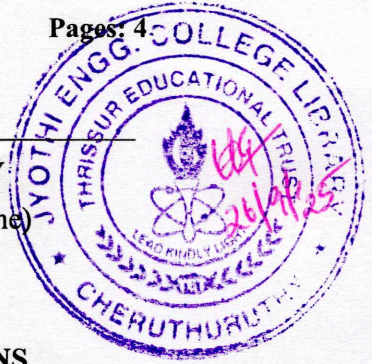Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S8 (S) Examination September 2025 (2019 Scheme)

Course Code: CST454
Course Name: FUZZY SET THEORY AND APPLICATIONS

Max. Marks: 100   **Duration: 3 Hours**

PART A
Answer all questions, each carries 3 marks.   Marks

1	Illustrate where a fuzzy logic based application is suitable?	(3)
2	A set of students {Alice, Bob, Charlie} and a set of subjects {Maths, Science} are given. How can the Cartesian product help to assign students to subjects?	(3)
3	Illustrate three operations on fuzzy relation with example?	(3)
4	Define cosine amplitude method of similarity measure	(3)
5		(3)
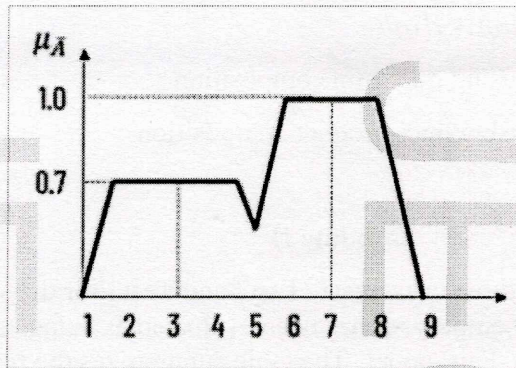
Find defuzzified value for given aggregated fuzzy output set using weighted average method:

6	Explain Rank ordering method of membership value assignment with an example.	(3)
7	Describe Sugeno model for fuzzy inference system?	(3)
8	How can Fuzzy Approximate Reasoning be applied to enhance decision making.	(3)
9	Explain the conditions for fuzzy clustering.	(3)
10	Write a note on Pattern Recognition using fuzzy.	(3)

PART B
Answer any one full question from each module, each carries 14 marks.

Module I

11 a) Consider two given fuzzy sets   (5)

$$A=\left\{\frac{1}{2}+\frac{.3}{4}+\frac{.5}{6}+\frac{.2}{8}\right\}$$

$B = \{ \frac{0.5}{2} + \frac{0.4}{4} + \frac{0.1}{6} + \frac{1}{8} \}$

Perform union, intersection, difference and complement over fuzzy sets A and B

b) Verify De Morgan's law for the fuzzy sets A and B where (9)

$A = \{ \frac{1}{2} + \frac{.3}{4} + \frac{.5}{6} + \frac{.2}{8} \}$

$B = \{ .\frac{5}{2} + .\frac{4}{4} + .\frac{1}{6} + \frac{1}{8} \}$

OR

12 An athletic race was conducted. The following membership functions are defined (14) based on the speed of the athletes.

$Low = \{ \frac{0}{100} + \frac{0.1}{200} + \frac{0.3}{300} \}$

$Medium = \{ \frac{0.5}{100} + \frac{0.57}{200} + \frac{0.6}{300} \}$

$High = \{ \frac{0.8}{100} + \frac{0.9}{200} + \frac{1}{300} \}$

Find the following

    i. $R = Low \times Medium$

    ii.   Find $S = Medium \times High$

    iii.   Find $T = R \circ S$ using max-min composition

    iv.   Find $P = R \circ S$ using max-product composition

Module II

13 a) A College has performed three tests Test1, Test2 and Test3 for the selection of (10) employees. The quality of employees has been evaluated as being one of three conditions C = {Excellent, Fair, poor}. The table summarizes the results of the employees for three cities. Find the similarity relation R among the three tests using cosine amplitude method.

	Test $_1$	Test $_2$	Test $_3$
C_1(Poor)	0.6	0.3	0.1
C_2(Fair)	0.5	0.5	0.4
C_3(Excellent)	0.0	0.2	0.6

b) Give a note on different approaches used for Defuzzification Fuzzy set to Crisp (4) sets

OR

14   Given the following data regarding three cities and the quality of their bridges,   (14)
      find the similarity between the cities using max-min method

	Test $_1$	Test $_2$	Test $_3$
C_1(Poor)	0.00	0.10	0.10
C_2(Fair)	0.04	0.04	0.08
C_3(Excellent)	0.02	0.04	0.06

Module III

15 a) The results of two implication processes arc as shown in fig. Find the aggregated   (9)
        output and the de fuzzified output using the (1) Centre of sums (2) Mean of
        maxima and (3) Weighted average methods.
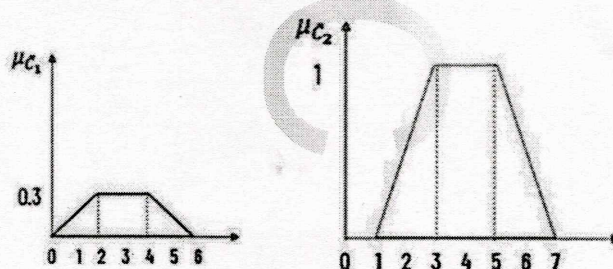
    b) The following data was determined by the pairwise comparison of work   (5)
        preferences of 100 people: When it was compared with software(S), 72 persons
        polled preferred hardware (H), 65 of them preferred teaching (T), 55 of them
        preferred business (B) and 25 preferred textiles (TX). On comparison with
        hardware (H), the preferences were 42 for T, 66 for B and 35 for TX. When
        compared with teaching, the preferences were 38 for B and 25 for TX. On
        comparison with business, the preferences were 20 for TX. Using rank ordering,
        plot the membership function for the "most preferred work."

OR

16 a) Using the inference approach, find the membership value for each of the triangular   (8)
        shapes having angles 20°, 40°, 120°.
                (i) approximately isosceles triangle
                (ii) approximately equilateral triangle
                (iii) approximately right-angled triangles
                (iv) Isosceles and right-angled triangle.

    b) Explain the various methods of development of membership function?   (6)

Module IV

17 a) Explain fuzzy rule based system.   (7)

    b) Prove that the following statements are tautologies.   (7)
        $$p \rightarrow q \equiv \neg p \vee q$$

OR

18 a) Explain the graphical inference technique using Mamdani Method.   (10)

    b) Explain the following rules   (4)

      i. Aggregation of the fuzzy rules
      ii. Decomposition of the fuzzy rules

Module V

19 a) Explain a fuzzy logic control system with the help of block diagram and example.   (7)

     b) Explain fuzzy pattern recognition using multiple features.   (7)

OR

20 a) Describe the significance of Fuzzy approach in clustering techniques. Illustrate Fuzzy c- means clustering algorithm?   (7)

     b) With an example, Explain Mamdani approach to Fuzzy logic controller design   (7)

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