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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

Accelerated Semester

MID TERMEXAMINATION- 2026

B.Tech-VIII Semester (CSE/IT/ECE/CE)

COURSE CODE (CREDITS): 21B1WMA831 (3) MAX. MARKS: 50

COURSE NAME: Soft Computing & Optimization Algorithms

COURSE INSTRUCTORS: Dr. B. K. Pathak MAX. TIME: 2 Hours

Note:*(a)All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Calculator is allowed

Q.No	Question	CO	Marks
Q1	Imagine that two restaurants, restaurant A and restaurant B, are evaluated based on customer satisfaction for five key aspects: **1-Food Quality, 2-Service Speed, 3-Cleanliness, 4-Ambience and 5-Pricing** Each aspect is rated between 0 and 1, where 0 represents very poor satisfaction and 1 represents maximum satisfaction. • Restaurant A's customer satisfaction levels across the five aspects are represented as fuzzy set *A*: A={(1,0.2),(2,0.5),(3,0.8),(4,1.0),(5,0.6)} • Restaurant B's customer satisfaction levels for the same aspects are given by fuzzy set *B*: B={(1,0.7),(2,0.4),(3,0.9),(4,0.5),(5,0.3)} Compute the following: (a) The best possible experience i.e. AUB if we pick the highest satisfaction from both restaurants. (b) The most conservative experience i.e. A∩B, considering only aspects where both restaurants perform well. (c) The dissatisfaction levels with restaurant A i.e. A^c. (d) The aspects where restaurant A is superior to restaurant B	CO-1	10

Q2	For a fuzzy set A, whose membership function $\mu_A(x)$ is given as: $\mu_A(x) = \begin{cases} \dfrac{(x-4)}{4} & ;\ 4 < x < 8 \\ 1 & ;\ 4 \le x \le 12 \\ \dfrac{(16-x)}{4} & ;\ 12 < x < 16 \\ 0 & ;\ otherwise \end{cases}$ (a) Find the membership value of {3, 6, 9, 12, 15, 18, 21}, (b) Plot the membership function of fuzzy set *A*. (c) Also find the cardinality of fuzzy se *A*.	CO-2	10
Q3	Let the universe of discourse be X={10, 20, 30, 40, 50} and let fuzzy set *Q*={(10, 0.2), (20, 0.4), (30, 0.6), (40, 0.8), (50, 1.0)} **(a)** Find the strong α-cut set of fuzzy set *Q* for α = 0.4, 0.6, and 0.8. **(b)** Find the level set of fuzzy set *Q*.	CO-2	10
Q4	Plot and write the **trapezoidal membership function** for a fuzzy set *A* with the following breakpoints: a=2, b=4, c=6, d=8. Also, find $\mu_A(x)$ for: (a) $x_1 = 3$ (b) $x_2 = 7$	CO-2	10
Q5	As a B.Tech student working on a drone project, you want to design a fuzzy logic system to assess the battery level status. You decide to define a fuzzy set for the term "Battery Level is High" using a triangular membership function. The triangular membership function is defined as follows: • Minimum battery level (start of "high"): 60% • Peak battery level (fully "high"): 80% • Maximum battery level (end of "high"): 100% Answer the following: **(a)** Write the equation for the triangular membership function for "Battery Level is High". **(b)** If the current battery level is 70%, what is the degree of membership in the fuzzy set "High"? **(c)** If the battery level is 55%, what is the degree of membership? Also plot the graph of the triangular membership function for the fuzzy set "Battery Level is High".	CO-3	10