JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

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

COURSE CODE (CREDITS): 21B1WMA831 (3)   MAX. MARKS: 15

COURSE NAME: Soft Computing & Optimization Algorithms

COURSE INSTRUCTOR: Dr. B. K. Pathak   MAX. TIME: 1 Hour

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	To compare two students based on their performance level in a competitive examination and the number of study hours, the following table shows the study hours and the corresponding performance levels of two students, represented as typical fuzzy membership values: <table><tr><td>Study Hours (per week)</td><td>Student A performance level</td><td>Student B performance level</td></tr><tr><td>5</td><td>0</td><td>0</td></tr><tr><td>10</td><td>0.4</td><td>0.3</td></tr><tr><td>15</td><td>0.6</td><td>0.5</td></tr><tr><td>20</td><td>0.8</td><td>0.7</td></tr><tr><td>25</td><td>0.95</td><td>0.85</td></tr><tr><td>30</td><td>1</td><td>1</td></tr></table> The universe of discourse is X={5,10,15,20,25,30}. Find the membership functions for the fuzzy sets representing the performance levels of Student A and Student B. Using standard fuzzy set operations, determine the following fuzzy sets: $A \cap B$, $A \cup B$, $\overline{A \cap B}$ and $\overline{A \cup B}$.	CO-1	3
Q2	Consider a universe of discourse X={a, b, c, d, e} with membership function defined as: $\mu_A(a)=0.1$, $\mu_A(b)=0.8$, $\mu_A(c)=1.0$, $\mu_A(d)=0.45$, $\mu_A(e)=0.0$ (a) Write the fuzzy set A using ordered pairs. (b) Represent the same fuzzy set using symbolic notation. (c) Identify the support, core, boundary and crossover point of the fuzzy set A.	CO-1	3

Q3	Let a fuzzy set C be defined on the interval $X=[0,10]$ with the following membership function: $$\mu_C(x) = \begin{cases} \frac{x}{4}, & 0 \le x \le 4 \\ 1, & 4 < x \le 6 \\ \frac{10-x}{4}, & 6 < x \le 10 \end{cases}$$ (a) Compute the cardinality of the fuzzy set C. (b) Determine the relative cardinality of C with respect to the universal set $X=[0, 10]$.	CO-2	3
Q4	In a university, student performance is evaluated using a Gaussian membership function to represent the fuzzy concept of *Good Performance* based on examination marks. Assume that for the fuzzy set Good Performance, the mean (c) of marks is 70 and the standard deviation (σ) is 10. (a) Write the Gaussian membership function for this fuzzy set. (b) Calculate the membership values for students scoring x=50, 60, 70, and 90. (c) Interpret the obtained membership values in terms of student performance.	CO-2	6