JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- FEB-2024

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

COURSE NAME: Soft Computing & Optimization Algorithms

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

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

1. For a fuzzy set A, whose membership function $\mu_A(x)$ is given as: **[CO-2] [6 Marks]**

$$\mu_A(x) = \begin{cases} \frac{(x-4)}{4} & ; \ 4 < x < 8 \\ 1 & ; \ 4 \le x \le 12 \\ \frac{(16-x)}{4} & ; \ 12 < x < 16 \\ 0 & ; \ otherwise \end{cases}$$

(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.

2. To compare two sensors based upon their detection levels and gain setting, following table gives gain settings and sensor detection level with a standard item being monitored provides typical membership values to represent the detection level for each of the sensors:

Gain Setting	Sensor 1 (S_1) detection level	Sensor 2 (S_2) detection level
0	0	0
20	0.5	0.35
40	0.65	0.5
60	0.85	0.75
80	1	0.9
100	1	1

The universe of discourse is $X = \{0, 20, 40, 60, 80, 100\}$. **[CO-2][5 Marks]**

(a) Find the membership function for the two sensors S_1 and S_2.

(b) Also find the fuzzy sets $S_1 \cap S_2$, $S_1 \cup S_2$, $\overline{S_1 \cap S_2}$ and $\overline{S_1 \cup S_2}$ using standard operations.

3. Consider a universe of discourse $X = \{1, 2, 3, 4, 5, 6\}$ and fuzzy set $A = \{(1, 0.2), (2, 0.5), (3, 0.8), (4, 0.4), (5, 0.9), (6, 0.6)\}$ **[CO-1 & CO-2][4 Marks]**

(a) Find the strong α cut set for $\alpha = 0.4,\ 0.6$ and 0.8.

(b) Also find the level set of A.