PG/IVS/MTM/402(U-1&2)/24
(Old)

M.Sc. 4th Semester Examination, 2024

APPLIED MATHEMATICS

PAPER – MTM-402(U-1&2)(Old)

Full Marks : 50

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

MTM– 402(Unit-1)

(*Fuzzy Mathematics with Applications*)

[*Marks* : 20]

GROUP – A

1. Answer any *two questions* : 2×2

(*a*) What is the difference between random uncertainty and non-random uncertainty ?

(*b*) Define the height of a fuzzy set, convex fuzzy set and fuzzy number.

(*c*) Suppose(10, 14, 19) is a triangular fuzzy number. Write its membership function and draw its diagram.

(*d*) Simplify the following expression
$2(5, 6, 8, 12) + 3(-1, 3, 4) - 5[-3, 2] + 8$.

GROUP – B

2. Answer any *two* questions : 4×2

(*a*) For the following three interval numbers
[1, 4], [2, 5] and [3, 8]
show by Zadeh's extension principle that the distributive law does not hold.

(*b*) Using α-cut method, show that
$2(-1, 5, 7) + 3\ (0, 3, 4) = (-2, 19, 26)$

(*c*) State and illustrate the Bellman and Zadeh's principle for fuzzy LPP.

(*d*) Prove De Morgan's laws for fuzzy sets.

GROUP – C

3. Answer any *one* question : 8×1

(*a*) State Zadeh's extension principle. Using Zadeh's extension principle, prove that $[1,3] + [5,8] = [6,11]$. $3 + 5$

(*b*) Conver the following fuzzy LPPs to equivalent crisp LPP by Verdegay's approach.

Maximum $z = x_1 + 3x_2$

subject to $2x_1 + 4x_2 \leq 4$ to 8

$2x_1 + 3x_2 \leq 1$ to 3

$0.2x_1 + 2x_2 \leq 9$ to 11

$x_j \geq 0,\ j = 1,2.$ 8

MTM– 402(Unit-2)

(*Soft Computing*)

[*Marks* : 20]

GROUP – A

1. Answer any *two* questions : 2×2

(*a*) What do you mean by hybrid computing ?

(*b*) Differentiate between crisp and fuzzy logic.

(*c*) The training set is given by the following input/output pairs

x_1	x_2	$x_1 \vee x_2$
0	0	0
0	1	1
1	0	1
1	1	1

The problem is to find the weights w_1 and w_2, threshold value θ such that the computed output is equal to the desired output for all training pairs.

(*d*) Write the limitations of binary coded GA.

GROUP – B

2. Answer any *two* questions : 4×2

(*a*) Let $X = \{1,2,3,4\}$ and $Y = \{a,b,c\}$ be two universes of discourses. Also, let $\tilde{A} = \{(1,0.2), (2,0.5), (3,0.7), (4,1.0)\}$, $\tilde{B} = \{(1,0.3), (2,0.4), (3,0.8), (4,0.7)\}$ and $\tilde{C} = \{(a,0.1), (b,0.6), (c,0.9)\}$. Determine the fuzzy relation of the following fuzzy rule "IF x is $\tilde{A}$ AND x is $\tilde{B}$ THEN y is $\tilde{C}$".

(*b*) Describe different learning process of artificial neural network.

(c) Show that Hebb net does not implement the logical AND gate for binary input and output patterns.

(d) Explain the necessity of cross-over and mutation in Genetic Algorithm.

GROUP – C

3. Answer any *one* question : 8×1

(a) Maximize $f(x) = \sqrt{x}, 1 \leq x \leq 20$ using binary coded GA (one iteration only). Given that population size N=6, initial population $x_1 = 100110$, $x_2 = 101011$, $x_3 = 101101$, $x_4 = 111000$, $x_5 = 101010$, $x_6 = 011110$. Random numbers to be used for selection : 0.19, 0.63, 0.97, 0.11, 0.70, 0.51. Cross-over probability, $P_c = 0.65$ and random numbers for cross-over : 0.60, 0.85, 0.57, 0.37, 0.70, 0.32. Mutation probability, $P_m = 0.05$ and random numbers for mutation : 0.21, 0.37, 0.02,

0.52, 0.07, 0.97, 0.04, 0.61, 0.17, 0.09, 0.14, 0.82, 0.08, 0.21, 0.37, 0.20, 0.25, 0.72, 0.24, 0.16, 0.47, 0.58, 0.49, 0.01, 0.18, 0.09, 0.82, 0.26, 0.43, 0.08, 0.76, 0.56, 0.26, 0.65, 0.54, 0.03.

(*b*) Using the perceptron learning rule, find the weights required to perform the following classifications
{[(1, 1), 0], [(−1, 1), 1], [(−1, −1), 1]}.

[Internal Assessment — 10 Marks]