PG/IVS/MTM/403/25

M. Sc. 4th Semester Examination, 2025

APPLIED MATHEMATICS

(*Soft. Computing*)

PAPER – MTM-403

Full Marks : 25

Time : 1 hour

Answer **all** questions

The figures in the right hand margin indicate marks

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

Answer any **two** questions of the following : 2×2

1. Write the mathematical form of the Generalized Modus Tollens inference rule.

2. Write the advantages of GAs.

3. Write the limitations of Hebbian neural net.

4. Define two linguistic fuzzy terms of linguistic variable 'Age'.

Answer any **two** questions of the following : 4×2

5. Define union and intersection of two fuzzy relations. Find union and intersection of two fuzzy relations $\tilde{R}$ and $\tilde{S}$ of fuzzy sets $\tilde{A}$ and $\tilde{B}$ having membership functions $\mu_{\tilde{R}}$ and $\mu_{\tilde{S}}$ given as follows :

$\mu_{\tilde{R}} =$

0.8	1	0.1	0.7
0	0.8	0	0
0.9	1.0	0.7	0.8

$\mu_{\tilde{S}} =$

0.7	1	0.8	0
0.3	0.6	1.0	0.3
0.5	0.9	0.1	0.7

6. Write the working procedure of GAs.

7. Generate the output of logical XOR function by McCulloch-Pits neuron model.

8. Explain different logical connectives for fuzzy logic.

Answer any **one** question of the following : 8×1

9. Using the perceptron learning rule, find the weights required to perform the following classifications

$$\{[(1,1),1],[(0,1),-1],[(1,0),-1],[(0,0),-1]\}.$$

10. Maximize $f(x) = 7 + 5x - x^2, 1 \le x \le 6$ using binary coded GA (one iteration only). Given that population size $N = 5$, initial population

$x_1 = 10011, x_2 = 10101, x_3 = 11110, x_4 = 11101,$

$x_5 = 10110.$

Random numbers for selection : 0.90, 0.30, 0.57, 0.11, 0.70.

Cross-over probability, $P_c = 0.8$ and random numbers for cross-over : 0.60, 0.85, 0.57, 0.37, 0.70. Also, the cross-over positions for single point crossover are 2 and 3.

Mutation probability, $P_m = 0.04$ and random

numbers for mutation : 0.21, 0.37, 0.02, 0.52, 0.07, 0.97, 0.14, 0.61, 0.17, 0.09, 0.03, 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.

[Internal Assessment — 05 Marks]