M.Sc. 4th Semester Examination, 2024

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

GROUP – A

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

   (*a*) What do you mean by fuzzy reasoning ?

   (*b*) Draw the McCulloch-Pitts neural net for the Boolean function $f(x_1, x_2, x_3) = x_1 x_2 \bar{x}_3$.

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

(*d*) Define union, intersection and complement of fuzzy relation.

GROUP – B

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

(*a*) Consider fuzzy relations $\tilde{R}$ and $\tilde{S}$ of three fuzzy sets $\tilde{A}, \tilde{B}$ and $\tilde{C}$ having relational membership functions $\mu_{\tilde{R}}$ and $\mu_{\tilde{S}}$ are as follows :

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

0.4	0.3	0
0.1	1.0	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

Compute the max-min composition of the fuzzy relations.

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

(*Continued*)

(*c*) Explain different activation functions of ANN.

(*d*) Explain Roulette-wheel selection procedure for binary coded GA.

GROUP – C

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

(*a*) Maximize $f(x) = 4 + 10x - x^2$, $1 \leq x \leq 9$ using binary coded GA.

Given that population size $N = 5$, initial population $x_1 = 10111$, $x_2 = 10101$, $x_3 = 11100$, $x_4 = 11101$, $x_5 = 10100$.

Random numbers for selection : 0.19, 0.63, 0.97, 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.

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. (one iteration only)

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

[Internal Assessment — 5 Marks]