

M.Sc. 4th Semester Examination, 2025

MATHEMATICS

(Lab : Soft Computing techniques using MATLAB)

[Practical]

PAPER — MTM-499

Full Marks : 25

Time : 2 hours

The figures in the right hand margin indicate marks

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

Answer one question which is

selected by lottery :

20 × 1

- 1. Implement the selection operator of Binary coded GA in MATLAB for the optimization problem : $\text{Max } f(x,y) = y \sin x - x \sin y, -5 \leq x, y \leq 5.$**

(Turn Over)

2. Implement the cross-over operator of Binary coded GA in MATLAB for the optimization problem : $\text{Max } f(x,y) = \sin x + \sin y, 0 \leq x, y \leq 10.$
3. Implement the mutation operator of Binary coded GA in MATLAB for the optimization problem $\text{Max } f(x,y) = xe^{-x^2-y^2}, -3 \leq x, y \leq 3.$
4. Implement the selection operator of Real coded GA in MATLAB for the optimization problem $\text{Max } f(x) = 20 + 7x - x^2, 1 \leq x \leq 7.$
5. Implement the cross-over operator or Real coded GA in MATLAB for the optimization problem : $\text{Max } f(x) = 20 + 7x - x^2, 1 \leq x \leq 7.$
6. Implement the mutation operator of Real coded GA in MATLAB for the optimization problem : $\text{Max } f(x) = 20 + 5x - x^2, 1 \leq x \leq 7.$

7. Write a MATLAB program to generate the output of logical AND function by McCulloch-Pitts Neuron Model with threshold value 2.
8. Write a MATLAB program to generate the output of logical NAND function by McCulloch-Pitts Neuron Model..
9. Write a MATLAB program to generate the output of logic ANDNOT function by McCulloch-Pitts Neuron Model.
10. Write a MATLAB program to display the graph of activation functions (a) binary step function (b) bipolar sigmoidal function.
11. Write a MATLAB program to calculate the outputs of a neuron when net input is 0.69 for activation functions (a) binary step function (b) binary sigmoidal function (c) bipolar step function (d) bipolar sigmoidal function.

12. Write a MATLAB program to find the weights required to perform the following classifications using Hebbian Learning Rule. Vectors $(1, 1, 1, 1)$ and $(-1, 1, -1, -1)$ are members of class with target value 1; Vectors $(1, 1, 1, -1)$ and $(1, -1, -1, 1)$ are members of class with target value -1.
13. Write a MATLAB program to train the logical OR function with bipolar inputs and targets using Hebbian Learning Rule.
14. Write a MATLAB program to train the logic AND function with binary inputs and bipolar targets using Perceptron Learning Algorithm.
15. Write a MATLAB program to display the graph of three fuzzy linguistic terms of a linguistic variable 'age' in same figure.
16. Write a MATLAB program to find intersection, union, and complement of two fuzzy relations

\bar{R} and \bar{S} having membership functions $\mu_{\bar{R}}$ and $\mu_{\bar{S}}$ given as follows :

$$\mu_{\bar{R}} =$$

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

$$\mu_{\bar{S}} =$$

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

17. Write a MATLAB program to find the 1st, 2nd and total projections for a fuzzy relation \bar{R} having membership functions $\mu_{\bar{R}}$ given as follows :

$$\mu_{\bar{R}} =$$

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

18. (a) Write a MATLAB program to find the max-min composition of two fuzzy \tilde{R} and \tilde{S} of three fuzzy sets \tilde{A}, \tilde{B} and \tilde{C} having membership functions $\mu_{\tilde{R}}$ and $\mu_{\tilde{S}}$ given as follows :

$$\mu_{\tilde{R}} = \begin{array}{|c|c|c|} \hline 0.4 & 0.3 & 0 \\ \hline 0.1 & 1.0 & 0.8 \\ \hline \end{array} = \mu_{\tilde{R}}$$

$$\mu_{\tilde{S}} = \begin{array}{|c|c|c|c|} \hline 0.7 & 1 & 0.8 & 0 \\ \hline 0.3 & 0.6 & 1.0 & 0.3 \\ \hline 0.5 & 0.9 & 0.1 & 0.7 \\ \hline \end{array}$$

19. Notebook & Viva : 05