M.Sc. 1st Semester Examination, 2024

APPLIED MATHEMATICS

(Lab 1 : Computational Methods : Using MATLAB)

[Practical]

PAPER — MTM-197

Full Marks : 25

Time : 1 hour

Select **two** questions on lottery basis

The questions are of equal value

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

1. Write a user defined function in MATLAB to calculate the roots of a general quadratic equation. Using it, find the roots of the equation $x^2 + 5x + 6 = 0$.

2. For a given square matrix of order 4, write a script program to carry out of the following :

   (*i*) Sort each column and store the result in an array B.

   (*ii*) Sort each row and store the result in an array C.

   (*iii*) Add each column and store the result in an array D.

   (*iv*) Add each row and store the result in an array E.

3. Write a user defined function in MATLAB to calculate the sum of a list of numbers. Using it, find the sum of all natural numbers between two specified numbers.

4. Write a script program to represent the graphs of the functions $\sin x$, $\sin 2x$ and $\sin 3x$ in $0 \le x \le 2\pi$ in same figure on the same axes with different line specifications. Also, put the text in each graph to identify the graphs.

5. Write a script in MATLAB to draw sin t and cos t in the interval $[0, 4\pi]$ in the same figure with grid, legend and different line specification.

6. Write a script program to solve the following linear equations

$$3x + 5y = 6z = 6$$
$$8x - y + 2z = 1$$
$$5x - 6y - 4z = -5$$

using rref, pinv and left division methods.

7. Write a script in MATLAB to draw following parametric equations $x = \sin t$ and $y = \cos t$ in the interval $[0, 2\pi]$ with the center marked by P.

8. Write a script program to create a mesh, surface and contour plots of the function $z = e^{x+iy}$ in the interval $-1 \le x \le 1$ and $-2\pi \le y \le 2\pi$. In each case plot the real part of z versus x and y.

9. For a diagonalizable matrix A, write a function program that returns true if A is positive definite and false otherwise. Also, write a script program to illustrate it.

10. Write a script in MATLAB to draw the following function in the interval $[-1,4]$

$$f(x) = \begin{cases} x^2 + 1, & -1 \le x < 0 \\ 0, & x = 0 \\ x^3 + 2x + 5, & x > 0 \end{cases}$$

11. Write a user define function to find the value of $\int_a^b f(x)dx$ by Simpson 1/3's rule. Use this function; write a script program to find the value of the following integration

$$\int_0^1 (x^2 + x)dx.$$

12. Write a script in MATLAB to draw the mesh and surface with contour of the equation

$z = xe^{-x^2-y^2}$ in the range $-3 \leq x \leq 3$ and $-3 \leq y \leq 3$.

13. Write a script program to find either minimum or maximum or sum according to your response of the function $y = x \sin x$ in the range $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$ with spacing 0.2 using switch statement.

14. Write a script in MATLAB to find the two solutions of the following linear equations
$$x + 2y + 3z = 7$$
$$x + y + 4z = 8$$

15. Write a script program that converts a decimal number to its binary, octal and hexadecimal form.

16. Write a script in MATLAB to create a list of numbers and perform the following operations on it (*i*) find maximum (*ii*) calculate summation (*iii*) sort descending order (*iv*) find norm.

17. Write a script in MATLAB to create two lists of numbers and perform the following arithmetic operations on it (*i*) addition (*ii*) subtraction (*iii*) element-wise multiplication (*iv*) elementwise division.

18. Write a script in MATLAB to create a real matrix and find its eigenvalues and eigenvectors.

19. Write a script in MATLAB to create two matrices of real numbers and perform the following arithmetic operations on it (*i*) addition (*ii*) subtraction (*iii*) multiplication (*iv*) division.

[Notebook and Viva : 05 Marks]

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