BACHELOR OF SCIENCE EXAMINATION, 2022

(2nd Year, 2nd Semester)

MATHEMATICS (HONS.)

PAPER – SEC-2

MATLAB

Time : Two hours   Full Marks : 40

Symbols and notaions have their usual meanings.

Answer *any four* questions.

1. a) Write a script file to sort the following numbers in descending order: 4

    $-1.2, -100, 0, 25, 1.9, 4/5.$

   b) Write a function to calculate gcd of two number. Call that function to find gcd and lcm of 18, 21, 27 and 111.   6

2. a) Write a MATLAB programme to compute all the roots of the equation

    $$e^{0.3x} - x^2 = -4$$

    using Newton-Raphson method correct upto three decimal places. Draw the graph of a suitable function for the initial guess.   6

   b) Write a code to find the value of the integral

    $$\int_0^\pi e^x \cos(x)\,dx$$

    using trapezoidal rule taking 16 subintervals. Verify

[Turn over

your answer after computing the same integral using the function 'trapz(x, y)'. 4

3. a) Write a script file to solve the differential equation

$$\frac{dy}{dx} = -y + 2\cos(x), \ y(0) = 1$$

using Euler's method taking step length $h = 0.01$ for $0 \le x \le 1$. The exact solution of the given equation is $y(x) = \sin(x) + \cos(x)$. Make a table to show both numerical solution, exact solution and error term at each step. Plot the graph of both the solutions with different colours, different line style and proper labeling. Find the point where the error term is maximum. 7

b) Write a function to find factorial of any natural number n. Use that function to calculate 6! 3

4. a) Create a 3×3 matrix A whose elements are random numbers in the interval (2, 7). Now create a 5×5 matrix B by surrounding A by zeroes all around. 3

b) Create a vector x of 20 numbers in A.P. with first term 1 and common difference 0.05 and calculate the sum of squares and sum of cubes of 20 numbers. 2

c) Solve the system of equations

$$x - y - z = 1$$
$$2x - 3y + 5z = 6$$
$$3x + y + 7z = 9$$

using inverse and backward division. Verify the solution directly. 5

5. a) Let $A = \begin{bmatrix} 1 & 3 & 4 \\ 2 & 1 & 5 \\ 6 & 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 4 & 3 \\ 6 & 1 & 2 \\ 3 & 5 & 4 \end{bmatrix}$. Calculate AB, AB^T and $A^T B$. 3

b) For the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \\ 3 & 1 & 2 \end{bmatrix}$, calculate $B = AA^T$. Find a matrix C such that $C^2 = B$. 4

c) Estimate $\sqrt{e}$ using 50 terms of an exponential series. 3

6. a) Graphically compare the functions $\cos(x)$, $1 - \frac{x^2}{2!}$ and $1 - \frac{x^2}{2!} + \frac{x^4}{4!}$ in $(0, 2\pi)$. 3

b) Write a script file to plot the surface

$$z = \frac{xy(x^2 - y^2)}{x^2 + y^2}, \ -3 \le x \le 3, \ -3 \le y \le 3$$

by computing the values of z over a 50×50 grid on the specified domain. 4

c) Plot a parametric space curve $x(t) = t$, $y(t) = t^2$, $z(t) = t^3$, $0 \le t \le 1$. 3