DHANAMANJURI UNIVERSITY

Examination- 2024 (Dec)

Four-year course B.Sc./B.A. 5^{th} Semester

Name of Programme : B.Sc./B.A. Mathematics
Paper Type : SEC(Theory)
Paper Code : SMA-009
Paper Title : MATLAB
Full Marks : 40
Pass Marks : 16 **Duration: 2 Hours**

The figures in the margin indicate full marks for the questions.

1. Choose and rewrite the correct answer for each of the following: **$1 \times 4 = 4$**

i) MATLAB saves variables in a part of the computer's memory, which is known as
a) Working Folder
b) Workspace
c) Current Folder
d) Current Directory

ii) The MATLAB command to generate a 3 × 3 identity matrix is
a) identity(3)
b) ident(3)
c) ones(3)
d) eye(3)

iii) A matrix is called full rank if
a) rank(A) = max(m, n)
b)rank(A) = min(m, n)
c)rank(A) = m
d)rank(A) = n

iv) The MATLAB command to generate all zero sparse matrix of order $m \times n$ is
a) sparse(m, n) b)SparseEye(m, n)
c)speye(m, n) d)Sparse(m, n)

2. Write very short answers for each of the following: $1 \times 6 = 6$

i) Write MATLAB command to load variables saved in a file called `myvar.mat` to the workspace.

ii) Write MATLAB command to open a file called `'myfile.txt'` for reading and writing.

iii) Write MATLAB command to plot a pie chart of data vector `x` with labels vector `y`.

iv) Write syntax of `for` loop in MATLAB.

v) Write MATLAB command to compute the condition number of a matrix `M`.

vi) What can you say about the rank of a square matrix `M` if the determinant of `M` is zero?

3. Write short answers for each of the following: $3 \times 4 = 12$

i) Write MATLAB code to plot the two-dimensional graph of the function $y = \tan x$ in the interval $[-\pi, \pi]$ in green color with x-label as 'x axis', y-label as 'y axis', title of the plot as 'Plot of the tangent function' and in the region $-6 \leq x \leq 6, -6 \leq y \leq 6$.

ii) Explain `eval`, `feval` and `inline` commands.

iii) Write a recursive function to find the factorial of a positive number.

iv) Define rank of a matrix. What is the relation between the rank and singularity of a square matrix?

4. Answer any one from the following : $6 \times 1 = 6$

i) Write MATLAB commands to make a 2 by 3 subplots of plot, scatter plot, bar plot, loglog plot, semilogx plot and semilogy plot with proper title and axis labels for the data

$$x = [0\ 1\ 2\ 3\ 4\ 5], \quad y = [1\ 2\ 4\ 5\ 6\ 2].$$

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ii) An electricity board charges the following rates to domestic users to discourage large consumption of energy:

1. For the first 100 units: 5 rupees/unit
2. For the next 100 units: 6 rupees/unit
3. Beyond 200 units: 7 rupees/unit

All users are charged a minimum of Rs. 150. If the bill amount so estimated is more than Rs. 2000, then an additional surcharge of 20% (of bill amount) is added. Write a MATLAB program to read the number of units consumed and print the total electricity bill.

5. Answer any one from the following : $6 \times 1 = 6$

i) Write a program to evaluate sine value of an angle (in degrees) entered by the user using the following series:

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots$$

Prompt the user to enter the number of terms to evaluate. Display the percentage error. The program should terminate if a negative angle is entered.

ii) Write a MATLAB function and subfunction to determine the standard deviation and mean given a vector of data values.

6. Answer any one from the following: $6 \times 1 = 6$

i) Write a MATLAB function to determine a root of a non-linear equation by Newton-Raphson method. Write MATLAB commands to call that function.

ii) Write a MATLAB function to find the solution of a system of linear equations by Gauss elimination method. Demonstrate how to call that function.

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