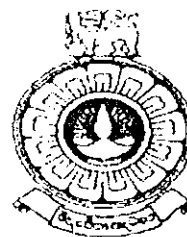THE OPEN UNIVERSITY OF SRI LANKA

B.Sc/B.Ed Degree Programme

Applied Mathematics – Level 05

ADU5320 – Introduction to MATLAB software

OPEN BOOK TEST (OBT) – 2024/2025

DURATION: ONE (01)–HOUR

Date: 23.02.2025   **Time: 01.00 p.m.-02.00 p.m.**

ANSWER **ALL** QUESTIONS

1. Determine whether each of the following statements is true or false, and **justify your answer.**

   a) The MATLAB command `linspace(0, 10, 5)` generates a vector [0, 5, 10] of points between 0 and 10.   (05 points)

   b) The MATLAB command of the expression $y = \cos x \cdot e^a + 5 \cdot \sqrt{x}$ is
      $$y = cos(x) * e^{\wedge}(a) + 5 * sqrt(x)$$ (05 points)

   c) In MATLAB, it is not possible to perform an operation without assigning the result to a variable.   (05 points)

   d) The command to display the value of the variable z is `print(z)` in MATLAB.   (05 points)

   e) The following MATLAB code is used to calculate the perimeter of a triangle using the function triangle_perimeter.m.

```
function p= triangle perimeter(a,b,c)

    a = input('Enter the length of side a: ');
    b = input('Enter the length of side b: ');
    c = input('Enter the length of side c: ');
% Calculate the perimeter
    perimeter = a + b + c;
% Display the result
    disp(p)
end
```

When the user inputs the values, this code will display the perimeter correctly without any errors.

(10 points)

2. i) A radioactive substance decays over time following an exponential decay model. The amount of the substance at time t is given by:

$$N(t) = N_0 \, e^{-\lambda t}$$

where:

- $N(t)$ is the amount of the substance at time t (in grams),
- N_0 is the initial amount of the substance (in grams),
- λ is the decay constant (in per seconds),
- t is time in seconds.

Given that, Initial amount N_0=100 grams; decay constant $\lambda = 0.1$ per second; and time range $t = 0: 0.5: 50$ seconds.

a) Write MATLAB code to plot the decay curve $N(t)$ as a function of time over the interval $t = 0: 0.5: 50$ (10 points)

b) Write MATLAB code to label the x-axis as "Time (seconds)", the y-axis as "Amount of Substance (grams)", and add a title "Exponential Decay of a Substance".   (10 points)

c) Write a user-defined MATLAB function to calculate the amount of substance $N(t)$ at a specific time $t = 30$ seconds.   (20 points)

ii) Given the following 4x4 matrix M:

$$M = \begin{bmatrix} 3 & 5 & 7 & 9 \\ 2 & 4 & 6 & 8 \\ 1 & 3 & 5 & 7 \\ 0 & 2 & 4 & 6 \end{bmatrix}$$

a) Write a MATLAB code to obtain the above matrix.   (05 points)

b) Write MATLAB code to extract a 2x2 submatrix from the top-left corner of matrix M (i.e., the submatrix formed by the first two rows and first two columns).   (10 points)

c) Write MATLAB code to extract the third row of matrix M as a row vector.   (05 points)

d) Write MATLAB code to replace the elements in the bottom-right 2x2 submatrix of M with zeros.   (10 points)

****** End of the Question Paper*******