00146

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme

Department	**: Mathematics**
Level	**: 05**
Name of the Examination	**: Final Examination**
Course Title and - Code	**: Introduction to MATLAB Software - ADU5320**
Academic Year	**: 2020/2021**
Date	**: 26.03.2022**
Time	**: 01.30 p.m. – 03.30 p.m.**
Duration	**: 02 hours**

General Instructions

1. Read all instructions carefully before answering the questions.

2. This paper consists **SIX (06)** pages.

3. This paper consists of **TWO** sections: Section **A** and Section **B**.

Section A

- This section is compulsory
- It consists of **FIVE(05)** Structured Essay Questions
- Each question carries 20 marks.
- Provide answers in the given space under each question.

Section B

- This section consists of **FIVE(05)** Essay Type Questions and each question carries 100 marks.
- Answer only any **THREE(03) questions** of them in a separate answer booklet given by the University .
- Answer for each question should commence from a new page.

4. Involvement in any activity that is considered as an exam offense will lead to punishment

5. Use blue or black ink to answer the questions.

6. Clearly state your index number in your answer script.

7.. When submit the answer scripts to invigilator/ supervisor, **Attach Section A to the answer**
booklet of the Section B.

SECTION A

(a) Write the code to evaluate the value of the following expression on MATLAB command window:

$$\frac{xy^{\frac{1}{3}}}{x^{\frac{1}{2}} + y/\sqrt{x}} \quad \text{when } x = 2, y = 3.$$

(b) Write the codes to evaluate the expression $e^2 \sin \pi / 6 + \log(3) \cos \pi / 9 - 5^3$ to accurate 15 digits.

(c) Write a MATLAB statement that generates the following error:

"*Expression or statement is incorrect–possibly unbalanced* (, {, *or* [."

(d) Write the codes to evaluate the square root value of each element in the array $x = [1\ 4\ 16\ 25]$.

(e) Consider the matrix A.

$$A = \begin{bmatrix} 1 & -3 & 2 & 0 \\ 0 & \left(\begin{matrix} -1 & 9 \\ -1 & 1 \end{matrix}\right) & & 0 \\ -5 & & & 0 \\ 2 & 0 & -1 & -3 \end{bmatrix}$$

Write the codes to access the elements of matrix A which are included in the double brackets as shown.

SECTION B

Answer **THREE** Questions **ONLY**.

2.

(a) The capacitance of two parallel conductors of length L and radius r, separated by a distance d in air, is given by

$$C = \frac{\pi \in L}{\ln\left[(d-r)/r\right]}$$

where $\in$ is the permittivity of air $\left(\in = 8.854\times10^{-12}\ \text{F/m}\right)$.

(i) Write a script that accepts user input for d, L, and r and computes and displays C.

(ii) Write the codes to run the script in part (i) to evaluate the value of C when $L = 1$ m, $r = 0.001$ m, and $d = 0.004$ m.

(b) Write a script containing a For loop to compute the array x to have the values $x(n) = n^3$ where n has the range from 1 to 10. Also write the codes to include a comment line at the beginning and display the values of the elements of the array x.

3. (a) Suppose the matrix $C = \begin{bmatrix} 1.1 & -3.2 & 3.4 & 0.6 \\ 0.6 & 1.1 & -0.6 & 3.1 \\ 1.3 & 0.6 & 5.5 & 0.0 \end{bmatrix}$.

Write the MATLAB codes to obtain each of the following matrix using matrix C. (Do not directly enter the entries).

(i) $\begin{bmatrix} 0.6 & 1.1 & -0.6 & 3.1 \end{bmatrix}$

(ii) $\begin{bmatrix} 0.6 \\ 3.1 \\ 0 \end{bmatrix}$

(iii) $\begin{bmatrix} -3.2 & 3.4 & 0.6 \\ 1.1 & -0.6 & 3.1 \end{bmatrix}$

(iv) $\begin{bmatrix} -3.2 \\ 0.6 \end{bmatrix}$

(v) $\begin{bmatrix} -0.6 & -0.6 \\ -0.6 & -0.6 \end{bmatrix}$

(b) (i) Write the codes to plot the functions $f_1(x) = \sin x$ and $f_2(x) = \cos 2x$ on the same axis using a blue line for $f_1(x)$ and a dashed red line for $f_2(x)$.

(ii) Calculate and plot the function $f_1(x) - f_2(x)$ on the same axis using a dotted black line. Include a title, axis labels, a legend, and a grid on the plot.

4. (a) The volume V and the surface area A of a torus are given by

$$V = \frac{1}{4}\pi^2 (a+b)(b-a)^2 \qquad A = \pi^2 (b^2 - a^2)$$

where a, b denote inner radius and outer radius respectively.

(i) Create a M-file function that computes V and A from the input arguments a and b.
(ii) Write the codes to test your function for the case $a = 7$cm, and $b = 12$cm.

(b) Write a M-file function that has two input arguments and returns the maximum value of its input arguments. Use an if else statement in your code.

5. (a) An object falls from a height of 600 feet without an initial velocity. The velocity function is $v(t) = 256 - 256e^{-\frac{t}{8}}$.

Write the codes to evaluate the following:

(i) the acceleration of the object at any time t.

(ii) the expression for the position of the object at any time t.

(iii) the limiting velocity v_{limit} when t becomes infinite.

(b) Write the codes to find the second order derivatives of the following functions.

(i) $(x-1)^{2/3} - (x+1)^{2/3}$

(ii) $\dfrac{2x+3}{x^3 - 2x^2 + 4}$

6.

(a) The following Table shows the number of Malaria deaths in thousands for African Region from year 2012 to 2019.

Year	2012	2013	2014	2015	2016	2017	2018	2019
No of deaths	485	462	431	409	380	351	341	342

Write the codes to evaluate the following (Hint: Use the linear interpolation):

(i) the estimated number of deaths found in the third quarter of the year 2016.

(ii) interpolate monthly deaths from the year 2012 to the year 2019 and plot the original data and the interpolated data in one figure.

(iii) forecast the number of Malaria deaths monthly for four years (from 2019 to 2023) and obtain the plot of original data and extrapolated data in one figure.

(b) (i) Let $u = \sin^{-1}\sqrt{\frac{x}{y}}$. Write the codes to evaluate $\frac{\partial^3 u}{\partial^2 x \partial y}$.

(ii) Write the codes to evaluate the integral $\int \frac{e^{\arccos x} + \ln(x^2)}{1+x^2}$