UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BMT 3083
COURSE	: SIMULATION OF ENGINEERING SYSTEM
SEMESTER/SESSION	: 1-2024/2025
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **4** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 7 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

a) For variables $x = 8.25$, $y = 3.45$,

i. Write a MATLAB command that define the variables x and y. (1 mark)

ii. Construct a MATLAB command that use x and y to create a column vector that has the following elements y^x, $cos\left(\frac{x}{y}\right)$, $x \times y$, and $x - y$. Represent the vector elements as variables $a, b, c,$ and d. (5 marks)

b) For the matrix *c* shown below, write the MATLAB command to extract the following elements from matrix *c* and assign them to variable *tesla*.

$$c = \begin{bmatrix} 1.1 & -3.2 & 3.4 \\ 0.6 & 1.1 & -0.6 \\ 1.3 & 0.6 & 5.5 \end{bmatrix}$$

i. All elements in the third column (1 mark)

ii. All elements in the second row (1 mark)

iii. The element with the value of 5.5 (1 mark)

c) For the following mathematical equation:

$$y(x) = (-2.5x^3 + 6x^2)e^{-x}$$

i. Describe a user-defined MATLAB function with the name *vertical* variable x as the input and the output is y. The function should be such that x can be a vector (use element-by-element operations). (6 marks)

ii. Write a MATLAB command to use the function to calculate the y values for $x = 1$ to $x = 1000$ in increment of 5. (3 marks)

QUESTION 2

a) State the alternative for these MATLAB commands.

i. multiple *if-elseif-else-end* (1 mark)

ii. *elseif* structure in matrix (1 mark)

b) Write a *for-loop* that adds 5 to the variable *ball* for 50 times and displays the final value using *fprintf* command. The initial value for variable *ball* is 10.

(6 marks)

c) Both the *while-end* and *for-end* statements are used to create loops. Describe the main difference between the two commands. (4 marks)

d) The *if-else-end* command structure provides a means for choosing one group of commands, out of a possible two groups, for execution. Describe the flowchart for *if-else-end* structure. (4 marks)

e) Produce a program for script file using *if-elseif-else-end* structure that multiply y with 10 if x is larger than y, multiply x with 20 if x is smaller than y and add 30 to x if x is equal to y. The resulting answer is not to be displayed in the Command Window. (6 marks)

f) Construct a MATLAB script that prompts the user to enter a value for the outside air temperature. If the temperature is above $30°C$, send the user a message to turn the aircond to HIGH. If the temperature is below $26°C$, send a message to the command window telling the user to turn the aircond to LOW.

(5 marks)

QUESTION 3

a) Sinks and sources are two of general classes of blocks available for use in Simulink. State the other six (4) classes. (4 marks)

b) Simulink can be used to model a system and then simulate the dynamic behaviour of that system. To create a simple model as shown in Figure 1, four Simulink blocks are required. Describe the blocks involved. (8 marks)

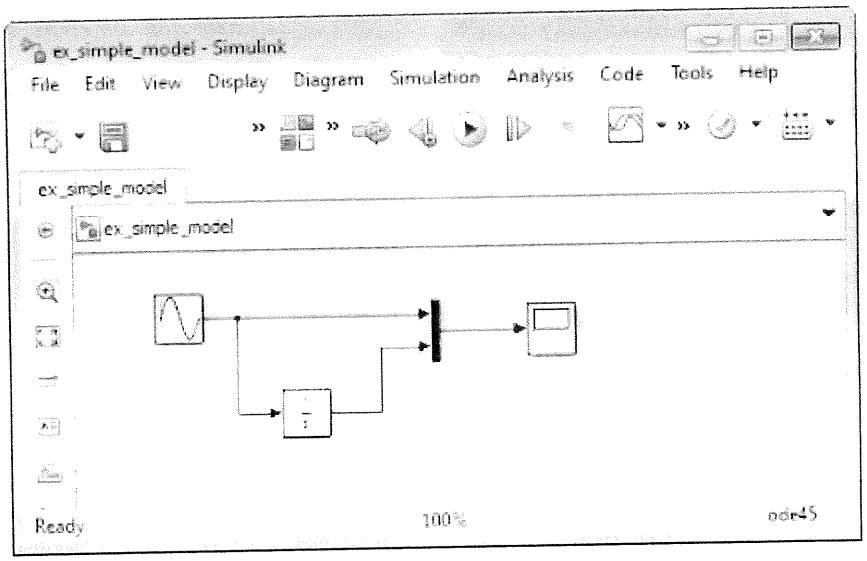

Figure 1

c) Blocks and lines are two major classes of items in Simulink. Explain the functions of blocks and lines. (4 marks)

d) Describe the two methods to open Simulink from the MATLAB window. (4 marks)

e) Mux and demux are the blocks in Signal and Routing library of Simulink that organizes signals from blocks. Describe the function of mux and demux blocks. (4 marks)

f) Explain the method for sending Simulink data into MATLAB using the configuration of a Scope block in Sinks library. (3 marks)

QUESTION 4

a) The model in Figure 2 solves a nonlinear equation $f(z)$. Based on the Simulink blocks in the model, recognize the equations at points A,B,C,D,E, and the final equation for $f(z)$ at point F. (7 marks)

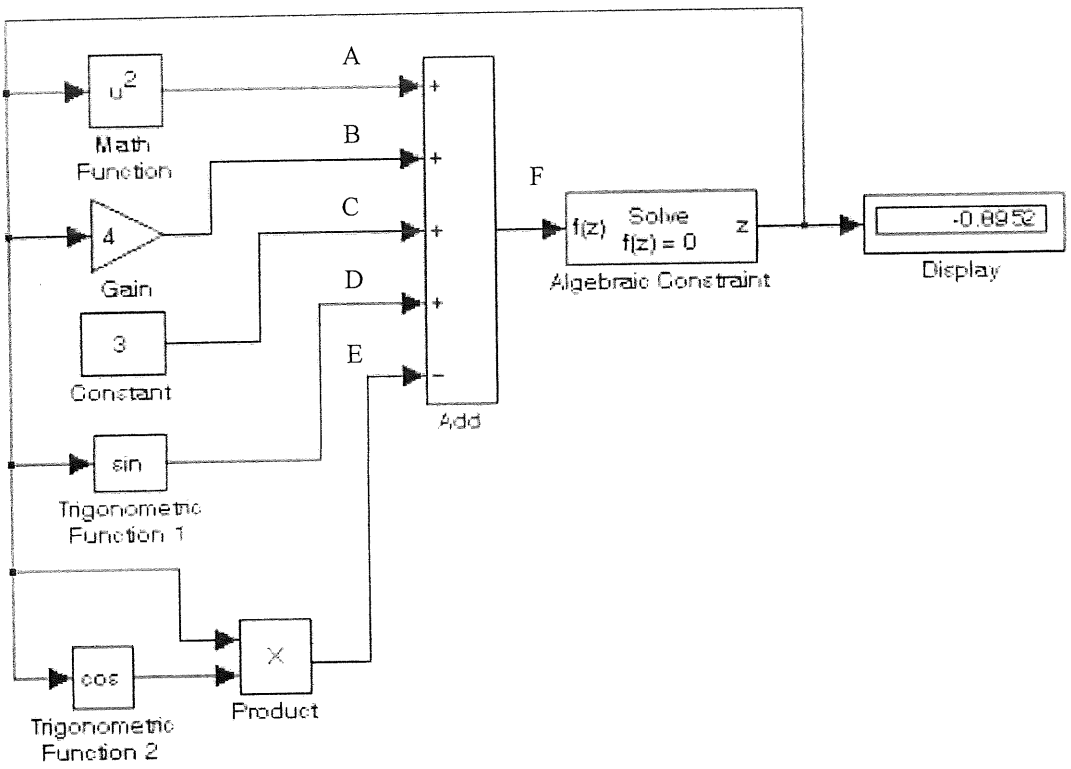

Figure 2

b) Produce a MATLAB program which will take a numerical user input. If the user input is within the 0–100 range, the program would display "Inside range"; otherwise, the program would display "Outside range." Moreover, if the input is greater than 25 and less than or equal to 50, the program would additionally display "First half," and if the number is more than 50 but less than or equal to 75, the program would additionally display "Second half." Use nested loop, relational and logical operator in your program. (11 marks)

c) At a local university, each engineering major requires a different number of credits for graduation. For example, recently the requirements were as shown in Table 1.

Table 1

Major	Credit for Graduation
Civil Engineering	130
Chemical Engineering	130
Electrical Engineering	126
Mechanical Engineering	129

Apply a MATLAB script that prompt the user to his/her engineering program. Use a switch/case structure to send the minimum number of credits required for graduation back to the command window. (10 marks)

----------End of Question----------