



COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

ADVANCE DIPLOMA/BACHELOR OF ENGINEERING PROGRAMME,
SEMESTER 2

EEE610/EEE603 ELECTRICAL ENGINEERING MODELING

FINAL EXAMINATION (SEMESTER 2, 2015)

(Max Marks – 100 Duration 3 Hours)

DATE/TIME/ROOM – Refer to Timetable

Instructions:

1. You are allowed 10 minutes extra time during which you are not to write.
2. Create a folder by your ID number on the desktop. In MATLAB®, change the current folder/directory to this folder.
3. There are 20 questions, attempt all questions in a single MATLAB script file (*M File*). You can use cell mode. Save the script file with your ID number. For example if your ID number is 2009001788 then your script file name should be *s2009001788.m*. You may also write your ID number as a comment in your script file.
4. After completing all the questions in your script file, publish the script file in html.
5. The function file for question no. 14 should be in a separate M File with the name *timefunc.m*. This file should be kept in the current folder/directory.

Total no of pages – 5 (including cover page)

1. Suppose that $x = 3$ and $y = 4$. Use MATLAB to compute the following. [4 Marks]

a. $\left(1 - \frac{1}{x^5}\right)^{-1}$

b. $3\pi x^2$

c. $\frac{3y}{4x-8}$

d. $\frac{4(y-5)}{3x-6}$

2. Use MATLAB to do the following [8 Marks]

a. Create a vector x with values from 0 to 2 in increments of 0.2.

b. Create a vector y with 7 equally spaced elements ranging from 1 to 15.

c. Create a vector z with 5 logarithmically spaced elements ranging from 10 to 1000

d. Using a special MATLAB function, create a 3x2 matrix A whose elements are all zero.

e. Using a special MATLAB function, create a 2x5 matrix B whose elements are all 3.

f. Create a 5x5 identity matrix C .

g. Create a character array D which has these characters with space "RUGBY WORLD CUP".

h. Create a 1 x 2 cell array E which has character "Rugby" in cell 1 and number 2015 in cell 2.

3. Suppose x takes on the values $x = 1, 1.2, 1.4, \dots, 5$. Use MATLAB to compute the array y that results from the function $y = 7\sin(4x)$. Use MATLAB to determine how many elements are in the array, and the value of the third element in the array y . [4 Marks]

4. Use MATLAB to determine how many elements are in the array

$$[\sin(-\pi/2); 0.05: \cos(0)]$$

Use MATLAB to determine the 10th element. [1 Mark]

5. Use MATLAB to find the roots of the following polynomials [2 Marks]

a. $13x^3 + 182x^2 - 184x + 2503$.

b. $36x^3 + 12x^2 - 5x + 10$.

6. Use MATLAB to plot the function $T = 6\ln(t) - 7e^{0.2t}$ over the interval $0 \leq t \leq 3$. Put a title on the plot and properly label the axes. The variable T represents temperature in degrees Celsius; the variable t represents time in minutes. The plot should be a red line with a circular data marker. The line width should be 2 and the data marker size should be 8. [6 Marks]

7. Use MATLAB to plot the functions $u = 2\log_{10}(60x + 1)$ and $v = 3\cos(6x)$ over the interval $0 \leq x \leq 2$. Properly label the plot and each curve (legend). The variables u and v represent speed in miles per hour; the variable x represents distance in miles. [6 Marks]

8. Use MATLAB to solve the following set of equations. [6 Marks]

$$\begin{aligned} 12x - 5y + 9z &= -50 & 7x + 14y - 6z &= 95 \\ -5x + 7y + 15z &= 145 \end{aligned}$$

9. Suppose that $x = [-15, -8, 9, 8, 5]$ and $y = [-20, 12, -4, 8, 9]$. What is the result of the following operations? [5 Marks]

- $a = (x < y)$
- $b = (x > y)$
- $c = (x \sim y)$
- $d = (x == y)$
- $e = (x > -4)$

10. A Matrix A is given as follows [3 Marks]

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 3 & 7 & 3 \\ 5 & 6 & 2 \\ 1 & 3 & 5 \end{bmatrix}$$

Use MATLAB to determine the following

- Find the transpose of A and put the result in B
- Sort each row and put the result in C
- Sort each column and put the results in D

11. In not more than 3 steps, create the following matrix A (Do not type the matrix out instead use built in functions to create it) [3 Marks]

$$A = \begin{bmatrix} 3 & 3 & 3 & 3 & 3 \\ 3 & 2 & 2 & 2 & 3 \\ 3 & 2 & 1 & 2 & 3 \\ 3 & 2 & 2 & 2 & 3 \\ 3 & 3 & 3 & 3 & 3 \end{bmatrix}$$

12. A Matrix A is given as follows [3 Marks]

$$A = \begin{bmatrix} 3 & 7 & -4 & 12 \\ 5 & 9 & 10 & 2 \\ 6 & 13 & 8 & 11 \\ 15 & 5 & 4 & 1 \end{bmatrix}$$

- Create a 4 x 3 array B consisting of all elements in the second through fourth columns of A.
- Create a 2 x 4 array C consisting of all elements in the second and fourth rows of A.
- Create a 2 x 3 array D consisting of all elements in the first two rows and the last three columns of A.

13. For the matrix A

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

Use built in MATLAB functions to determine the following:

- The inverse of A [1 Mark]
- The eigenvalues of A [1 Mark]
- The determinant of A [1 Mark]
- The rank of matrix A [1 Mark]

14. An object is thrown vertically with a speed v_0 reaches a height h at time t , where

$$h = v_0 t - \frac{1}{2} g t^2$$

Write and test a user defined function (in a separate M File) that computes the time t required to reach a specified height h , for a given value v_0 . The functions inputs should be h, v_0 and g . The function name should be *timefunc*. Test your function for the case where $h = 120m$, $v_0 = 70m/s$ and $g = 10m/s^2$. [8 marks]

15. Use a **for** loop to determine the sum of the first 10 terms in the series $5k^3$, $k = 1, 2, 3, \dots, 10$. [3 Marks]

16. Use a **while** loop to determine how many terms in the series $2k$, $k = 1, 2, 3, \dots$, are required for the sum of the terms to exceed 2000. What is the sum for this number of terms? [3 Marks]

17. Write a script file using conditional statements to evaluate the following function, assuming that the scalar variable x has a value. The function is

$$y = e^{x+1} \text{ for } x < -1,$$

$$y = 2 + \cos(\pi x) \text{ for } -1 \leq x < 5 \text{ and}$$

$$y = 10(x - 5) + 1 \text{ for } x \geq 5$$

Use your file to evaluate y for $x = 15$.

[6 Marks]

18. A certain electric circuit has a resistor and a capacitor. The capacitor is initially charged to 98.8V. When the power supply is detached, the capacitor voltage decays with time as the following data table shows. Find a best fit line through the data points. Plot the best fit line and the data on the same plot. [10 Marks]

Time(s)	Voltage (V)
0.0	98.8
0.5	60.8
1.0	36.8
1.5	19.8
2.0	11.8
2.5	5.8
3.0	2.8
3.5	0.8
4.0	1.8

19. Use the following script to create your x and y data set. Using `polyfit` function, determine the best fit line through the data points. Plot the best fit line and data on the same plot. [10 Marks]

```
%create data

Close all;
clear;
clc;

x = -5:0.1:5;
y = 3*x.^3 - 2*x.^2 + x - 2;
y = y - 7*randn(1, length(x));
```

20. Create a three dimensional surface plot of the following equation. The x and y interval should be $[-5, 5]$ [5 Marks]

$$z = x^2 + y^2 - 6$$

THE END