Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: MATLAB FOR ENGINEERS [ELE 3287]

(OPEN ELECTIVE – I)

REVISED CREDIT SYSTEM

Time: 3 Hours 17 MAY 2016 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- **Write clearly the code, input and output**

1A. Define the variables a, b, c and d as: a = 15, b = -7.6, c = 61.34 and d = 0.5(ac - b), then evaluate

I. $a + \frac{ab}{c}\frac{(a+d)^2}{\sqrt{|ab|}}$

II. $de^{\left(\frac{d}{2}\right)} + \frac{\frac{ad+cd}{\frac{20}{a}+\frac{30}{b}}}{(a+b+c+d)}$ ***(03)***

1B. Create a 5x7 matrix A with elements (integer) randomly distributed between -50 and 50.

I. Create a 3x5 matrix B from 1st, 3rd and 4th rows, and the 1st, 3rd through 5th and 7th columns of the matrix A

II. Create a 17 elements-long row vector U from elements of the 3rd row and the 5th and 7th columns of matrix A. ***(03)***

1C. The equation for the correlation coefficient is given by

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[(n\sum x^2) - (\sum x)^2][(n\sum y^2) - (\sum y)^2]}}$$

$\sum x$ is the sum of x value; $\sum x^2$ is the sum of square of x value

$\sum y$ is the sum of y value; $\sum y^2$ is the sum of square of y value

$\sum xy$ is the sum of the product of the corresponding x and y values

n is the number of points included in the fit

x	-3.78	-0.52	-1.83	-2.01	0.28	1.08	-0.94	0.59	0.69	3.04
y	-5.62	-3.3	-2.05	-2.83	-1.16	0.52	0.21	1.73	3.92	4.26

Develop an algorithm that takes input data point (x, y) and give output r. ***(04)***

2A. Use Matlab to show that the sum of infinite series $\sum_1^n \frac{1}{n^2}$ converges to $\pi^2/6$. Do it by computing the sum for:

a) n = 100

b) n = 1000

c) n = 10000

Also find the error in each case. ***(03)***

2B. Calculate the range a ball would travel when it is thrown with an initial velocity of 20 m/s at an angle θ. Calculate this range for all angles between 0^o and 90^o in 5^o steps. Determine the angle θ that result in maximum range for the ball. Plot the trajectory (x, y) of the ball for angles between 5^o and 85^o in 20^o increments with different colors. Plot the maximum range trajectory with a thicker line. g = 9.81 m/s^2.Label the axes and add a title to the plot.

$$V_x = Vcos(\theta), \qquad V_y = Vsin(\theta), \qquad t_{max} = \frac{2Vsin(\theta)}{g}$$

(04)

2C. The graph of the function $f(x) = ax^3 + bx^2 + cx + d$ passes through the points (-2, -3.4), (-0.5, 5.525), (1, 16.7) and (2.5, 70.625). Determine the constants a, b, c, d. ***(03)***

3A. A simply supported beam that is subjected to a constant distributed load w over half of its length. The deflection y as a function of x is given by the equations:

$$y = \frac{-wx}{384EI}(16x^3 - 24Lx^2 + 9L^3) \ \ for\ 0 \le x \le \frac{L}{2}$$
$$y = \frac{-wL}{384EI}(8x^3 - 24Lx^2 + 17L^2x - L^3) \ \ for\ \frac{L}{2} \le x \le L$$

Where E is the elastic modulus, I is the moment of inertia and L is the length of the beam. For the beam L = 20m, E = 20 x 10^9 Pa (steel), I = 348 x 10^{-6} m^4 and w = 5 x 10^3 N/m. Make the plot of the deflection of the beam y as a function of x. ***(03)***

3B. The nth Fibonacci number is defined by following recursive equations

f(1) = 1; f(2) = 2; f(n) = f(n-1) + f(n- 2)

Write a function file to calculate and write out the nth Fibonacci number for n> 2 where n is input to the user and output is the Fibonacci number. Use a while loop to perform the calculation. Test your program by calculating f (10). ***(03)***

3C. Write a function that accepts a character string and return a logical array with true values corresponding to each vowel and false value everywhere else. Be sure the function works properly for both lower and upper case characters.

Eg. 'MAtLab' = [0 1 0 0 1 0] ***(04)***

4A. A vector x is given by x = [1:50]. Write a program using **Logical indexing** to find the even and prime number in x and also its sum. ***(03)***

4B. Write a function that can synthesize a waveform in the form

$x(t) = \mathrm{Re}\,al\left\{\sum_{k=1}^{N} X_k e^{j2\pi k f_o t}\right\}$ Where f_o is the fundamental frequency.

For f_o = 25Hz, $X_k = j4/k\pi$ for k odd and 0 for k even, plot $x(t)$ for N=5,10 and 25. Explain what happens when N→∞. t =[0:0.001:4/f_o] ***(04)***

4C. Write a program to find the derivative of function $f(x) = \frac{3x^2-2x+4}{x^2+5}$. Subplot f(x) and f'(x) in the domain -2 ≤ x ≤ 2. ***(03)***

5A. Write a user – defined function that fits data points to a power function of the form $y = bx^m$.Name the function [b, m] = powerfit(x, y), where the input arguments x and y are vectors with the coordinates of the data points, and the output argument b and are the constants of the fitted power equation.

I. Make a plot that shows the data points and the function

II. Make a plot that shows the data points with circle markers and spline interpolation with a solid line.

X	0.5	1.9	3.3	4.7	6.1	7.5
Y	0.8	10.1	25.7	59.2	105	122

(03)

5B. A deflection in a crystal lattice where a raw of atoms is missing is called an edge dislocation. The stress field around an edge dislocation is given by:

$$\sigma_{xx} = \frac{-Gb}{2\pi(1-v)}\frac{y(3x^2+y^2)}{(x^2+y^2)^2}\ ; \qquad \sigma_{yy} = \frac{Gb}{2\pi(1-v)}\frac{y(x^2-y^2)}{(x^2+y^2)^2}\ ;$$

$$\sigma_{xy} = \frac{Gb}{2\pi(1-v)}\frac{x(x^2-y^2)}{(x^2+y^2)^2}$$

Where G is the shear modulus, b is the Burgers vector, and v is Poisson's ratio. Plot stress components (each in a separate figure) due to an edge dislocation in aluminium for which G = 27.7 x 10^9 Pa, b = 0.286 x 10^{-9} m, and v = 0.334. Plot the stress in the domain -5 x 10^{-9} ≤ x ≤ 5 x 10^{-9} m and -5 x 10^{-9} ≤ y ≤ 5 x 10^{-9} m. Plot the coordinates x and y in the horizontal plane, and stresses in the vertical direction. (only write the code) ***(03)***

5C. An RLC series circuit with R = 1Ω, L = 1H, & C = 10mF is connected to a dc source of 10V through a switch. Using Simulink plot the inductor current and the capacitor voltage for time, 0 ≤ t ≤ 10s, if the switch is closed at t = 1s & the circuit elements are initially relaxed. Draw the block diagram and the results.

$$V - i(t)R - L\frac{di(t)}{dt} - V_c(t) = 0$$

$$V_c(t) = \frac{1}{c}\int i(t)dt$$

(04)