Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH MAKEUP EXAMINATIONS, JUNE 2018

SUBJECT: MATLAB FOR ENGINEERS [ELE 3287] (OPEN ELECTIVE-I)

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 26 JUNE 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions
- Missing data may be suitably assumed
- Use of MATLAB help is allowed. Use of Internet is NOT allowed
- Save your work regularly
- Read the note given below every question carefully
- Evaluation will be carried based on information available in the answer script **ONLY**

1A. Write a MATLAB function 'mycube' which takes length, breadth and height as inputs and gives volume as output

In the answer booklet: Lines of codes ***(02)***

1B. Write a MATLAB function 'myshift' which takes a word as input. The output word should be such that every letter of the input word is replaced by its previous letter

Example 1:	Example 2:
Input: 'hello'	Input: 'MATLAB'
Output: 'gdkkn'	Output: 'LZSKZA'

In the answer booklet: Lines of codes ***(04)***

1C. Write a MATLAB function 'greetings' which has no input and output arguments. When the function is called from the command window, there should be message *'Good Morning!', 'Good Afternoon!', 'Good Evening!'* depending upon actual time (system time) when the function is called

In the answer booklet: Lines of codes ***(04)***

2A. Create an m-file to draw line between two user selected points in a 2D graph and compute slope and distance between the two points. The program should have following flow:

Step 1. Create a 2D linear graph with x-axis and y-axis limits ranging from 0 to 5

Step 2. Display message 'Select point A' in the command window and user must be able to select (click) one point in the axes. X and Y coordinates of point A must be available to the user for computations. Ensure that axis limits don't change during interactive selection of point A.

Step 3. Suitable marker for point A must be put in the graph along with text 'Point A'.

Step 4. Display message 'Select point B' in the command window and user must be able to select (click) one point in the axes. X and Y coordinates of point B must be available to the user for computations. Carry out step 3 for point B.

Step 5. Draw a line joining point A and B. Compute slope of the line and distance between point A and B and display the results in the command window

Hints: Functions – axes, ginput, text; $slope = \frac{y_2 - y_1}{x_2 - x_1}$; $distance = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

In the answer booklet: Lines of codes with code section and necessary comments ***(05)***

2B. Evaluate the following using MuPAD

a) Find the fifth derivative of $\sin x^2$ and evaluate it at $x = 5$

b) $\sum_{n=1}^{\infty} \frac{1}{k^2}$

In the answer booklet: MuPAD codes and answer ***(02)***

2C. Plot and solve: $\sin(x) = x^2 - 5x + 6$

In the answer booklet: MuPAD codes and answer ***(03)***

3A. Develop an app using App Designer to obtain the path traced (height vs. distance) by a projectile thrown at an angle θ (w. r. t. ground) with a velocity 'V_0'. The governing equations are:

$$t_{max} = \frac{2V_0 \sin\theta}{g}$$

$$h(t) = V_0 t \sin\theta - \frac{gt^2}{2}$$

$$d(t) = V_0 t \cos\theta$$

where,

- t is a time array - $[0 \ldots t_{max}]$. This array is used to calculate height (h) and distance (d) covered by the projectile at different instances of time (t).
- $g = 9.81 m/s^2$

Consider $V_0 = 25\ m/s$

Following points must be considered during development of the app:

- The app should have only three components - a slider to vary θ from 0° to 90°, UIAxes to plot the path traced by the projectile (height vs. distance) and an uneditable edit field to display the time taken by the projectile to reach the ground (t_{max})
- Set V_0 and g as global variables
- Provide necessary axis label and title. Also, x-axis limits should be fixed from 0 to 70 and y-axis limits from 0 to 35 throughout the running of the app
- The plot should dynamically change to the changing value of θ via slider

In the answer booklet: callback functions, plot of height vs. distance & time taken by the projectile to reach the ground when $\theta = 30°$ ***(07)***

3B. Consider following data:

```
x = [1 2 3 4 5];
y = [5.5 43.1 128 290.7 498.4];
```

Using 'cftool', fit it a polynomial curve for the data with 'y' as the dependent variable. Which degree fit is good fit? Give reasons

In the answer booklet: Chosen polynomial equation and reason ***(03)***

4A. The governing equation of motion of a damped pendulum is,

$$m\frac{d^2\theta}{dt^2} + c\frac{d\theta}{dt} + m\frac{g}{l}\sin\theta = 0$$

Where 'm' is the mass (kg) of the pendulum bob, 'c' is the damping coefficient (kg/s), $g = 9.81\ m/s^2$, 'l' is the length (m) of the pendulum and 'θ' is the angular displacement.

Considering '$m = 0.15\ kg$', '$l = 0.3m$', '$c = 0.014\ kg/s$' and '$\theta(0) = 20°$', find the time (in seconds) taken by the pendulum to come to halt.

In the answer booklet: Simulink block diagram with necessary annotations, halt time in seconds when θ is less than 0.3°. ***(06)***

4B. Generate two signals, sinusoidal (A) and triangular (B) with frequency 5Hz and 10Hz respectively. Let both signals have amplitude of 1. Generate train of pulses based on the rule that, if magnitude of A is less than that of B, pulse will go high (1) and low (-1) otherwise.

Scope should show all the three waveforms in one window

In the answer booklet: Simulink block diagram with necessary annotations ***(04)***

5A. Write a short note on interfacing Arduino with MATLAB. How can we deploy MATLAB algorithm in Arduino? ***(04)***

5B. Raspberry Pi and laptop is connected to WiFi network and Raspberry Pi is assigned with IP address '169.254.0.2'. An Arduino is connected to COM port 5 of the same laptop. A digital PIR sensor is connected to digital pin 8 of Arduino to monitor movement of PIR object. Write a MATLAB code to trigger Raspberry Pi camera connected to Raspberry Pi and take snapshot when there is detection of a moving object by the PIR sensor.

In the answer booklet: Lines of codes ***(03)***

5C. An LED is connected to digital pin 9 of Arduino Uno. A distance measuring analog sensor that generates 0 to 5V is connected to analog pin A0 of Arduino Uno. Write a MATLAB program to vary the flickering frequency of the LED depending on the position of any object from the sensor.

In the answer booklet: Lines of codes ***(03)***