MATLAB FOR MECHANICAL ENGINNERS

Instruction (Periods per week)	2 Periods
Duration of End Examination	3 Hours

Module-1	Basics of MATLAB, MATLAB windows, On-line help, Input-output, File types, General commands should remember. Add, multiply, and exponentiation numbers, use trigonometric functions; and control screen output with format.-	2H
Module-2	Creating and Working with Arrays of Numbers, Creating and Printing Simple Plots, Write and execute a script file, Write and execute a function file.-	3H
Module-3	Arrays and Matrices, Working with Anonymous Functions, Symbolic Computation, Importing and Exporting Data, Working with Files and Directories, Publishing Reports.-	2H
Module-4	Matrices and Vectors, Matrix and Array Operations, Character strings, Command-Line Functions,-	3H
Module-5	Using Built-in Functions, Saving and Loading Data, Programming in MATLAB: Scripts and Functions: Script Files, Function Files	- 3H
Module-6	Applications: Linear Algebra, Curve Fitting and Interpolation, Numerical Integration, Ordinary Differential Equations, Nonlinear Algebraic Equations.-	2H
Module-7	Graphics: Basic 2-D Plots, Using subplot for Multiple Graphs, 3-D Plots, 3-D Surface Graphics	2H

List of the Exercises-13H

1) Figure 1 shows a frame in which the structural members support the 5 kN load. The load may be applied at any angle α (– 90º to + 90º). The pins at A and B need to be designed to support the maximum force transmitted to them. Write a MATLAB program to plot the forces at A and B as a function of α and find their maximum values and corresponding angles α.

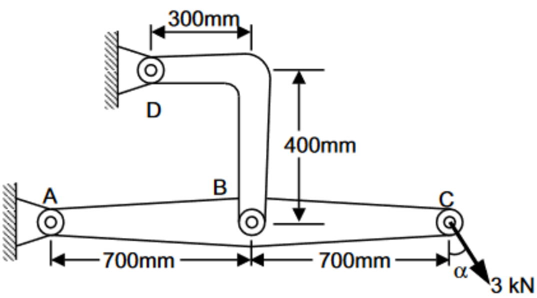

Figure. 1

2) In figure 2, the spring is un stretched when α = 0 and k is the spring constant. Write a MATLAB program to compute and plot the mass m corresponding to equilibrium as a function of α for values of α from 0° to 90º. Find the value of α corresponding to equilibrium m=2.5kg. Given R = 210 mm, d = 50 mm and k = 1.2 kN/m.

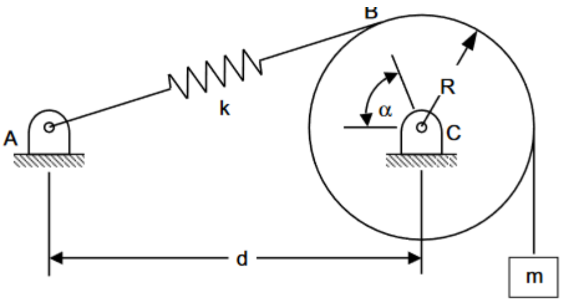

Figure. 2

3) Figure 3 shows a crank shaft mechanism where a couple M is applied to the crank AB to maintain the equilibrium of the system. The force applied to the system is F. Write a MATLAB program to plot the ratio of M/F as a function of crank angle α from 0 to 180 degrees. Given a = 50 mm and A = 150 mm. Determine the value of crank angle α for which the ratio M/F is maximum and the corresponding value of M/F.

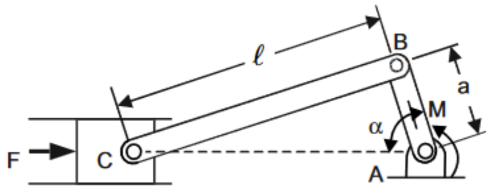

Figure 3

4) Figure 4 shows axle pulley system where the coefficient of friction between cable ABCD and the pulley varies between 0 and 0.60. Write a MATLAB program to determine, (a) the values of α for the system to remain in equilibrium (b) the reactions at A and D (c) Plot α as a function of the coefficient of friction.

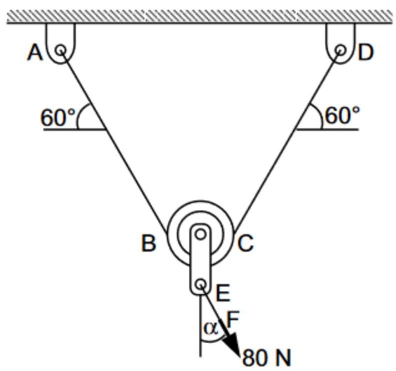

Figure 4

5) Figure 5 shows a safety bumper placed at the end of a racetrack to stop out-of-control vehicles. The force that the bumper applies to the vehicle is given by $F = Kv^3 (x + 1)^3$ where K = 32 kg-s/m5 (a constant) x = displacement of the front edge of the bumper v = velocity of the front edge of the bumper. A vehicle of mass 2000 kg hits the bumper at a speed of 100 km/h. Write a MATLAB program to determine and plot the velocity of the vehicle as a function of x for $0 \le x \le 5$m.

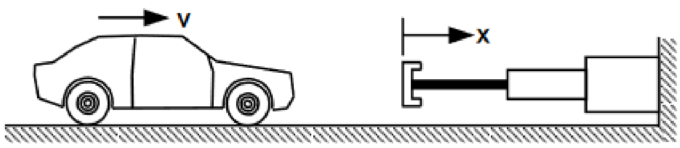

Figure 5

6) A 5 kg block is attached to a cable and to a spring as shown in Fig. 6. The constant of the spring is k = 3 kN/m and the tension in the cable is 30 N. When the cable is cut,

(a) derive an expression for the velocity of the block as a function of its displacement x, (b) determine the maximum displacement x m and the maximum speed v m, (c) plot the speed of the block as a function of x for $0 \le x \le xm$.

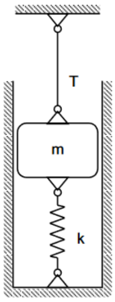

Figure 6

7) Figure 7 shows the slider crank mechanism. Write a MATLAB program that calculates and plots the position, velocity and acceleration of the piston for one full revolution of the crank. Assume that the crank is rotating at a constant speed of 550 rpm. Given radius of crank = 125 mm and radius of crank shaft = 250 mm.

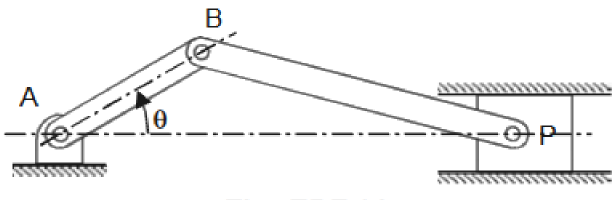

Figure 7

8) Write a MATLAB script for plotting (a) the non-dimensional response magnitude for a system with harmonically moving base shown in Fig. 8 (b) the response phase angle for system with harmonically moving base.

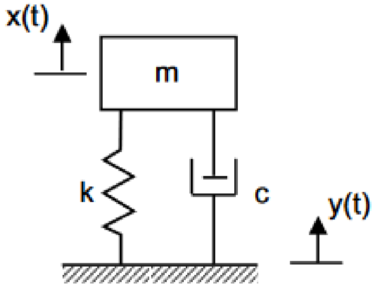

Figure 8

9) Rectangular fin of uniform cross section, with width of 18mm and thickness of 5mm and length of 100 mm is attached to the wall with surface temperature of 320 °C. The fin is made of material with thermal conductivity of 50 w/mk. The ambient air temperature is 24°C and the convection heat transfer coefficient of 15W/m k.

1- (**Plot**) the temperature variation for the following boundary condition

a- Infinitely long fin, b- Adiabatic fin tip, c- Convection from the fin tip.

2- Find the temperature at the midpoint of the fin length

3- Find the heat transfer rate, 4- Find the fin efficiency