

Solve all questions

Assume any required data and/or equations using your Engineering Background

**Question1: (10 Marks)**

The effect of damping factor on the magnification factor for different frequency ratios is given by the following equation:

$$\frac{x}{x_0} = \frac{1}{\sqrt{\left[1 - \left(\frac{\omega}{\omega_n}\right)^2\right]^2 + \left(2\xi \frac{\omega}{\omega_n}\right)^2}}$$

$\frac{x}{x_0}$  is the magnification factor

where  $\frac{\omega}{\omega_n}$  is the frequency ratios (from 0 to 3)

$\xi$  is a damping factor (from 0.1 to 0.9)

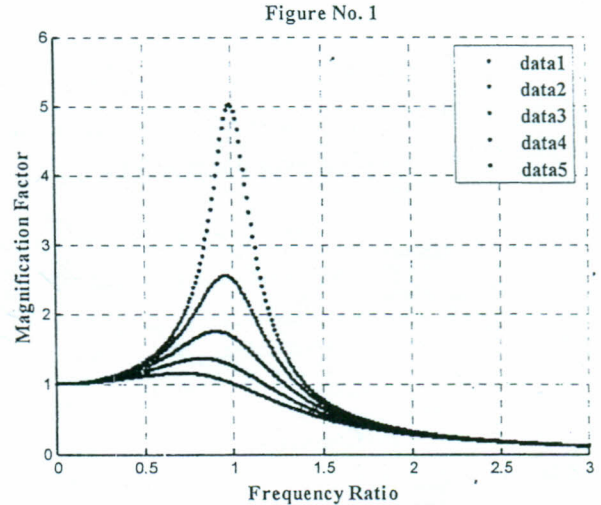


Figure (1)

Write a Matlab Program that solves this problem, and constructs figure (1) with all its details.

**Question2: (10 Marks)**

For a uniformly loaded span of a cantilever beam attached to a wall at  $X=0$  with the free end at  $X=L$ , the formula for the vertical displacement from  $Y=0$  under the loaded condition with  $Y$  the coordinate in the direction opposite that of the load can be written as follows:

$$Y = - (X^4 - 4X^3 + 6X^2)$$

It is required to graph the shape of the deflection curve when the beam is in its loaded condition and how does it compare with its unloaded perfectly horizontal orientation, such as shown in figure (2)

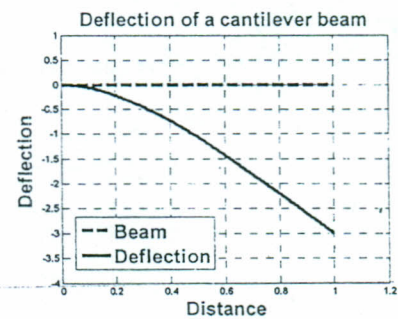
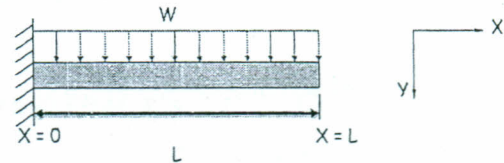


Figure (2)

**Question3: (10 Marks)**

The scores received by 100 students on the midterm exam and the number of students that obtained each score are:

Score	100	90	80	70	60	50	40
No. of Student	5	10	15	25	30	10	5

Using a Matlab program, generate a histogram of these data, and find the average score.

**Question4: (10 Marks)**

For the following arrays: A= [1 3 5;-1 -4 5; 1 6 2]; B= [1 2 3; 8 6 5; 1 -4 -7]; Q= [-1 1 2 -3 4 -2];

Find through computer programming:

- a) H=B\*A
- b) A (3, :)
- c) G=B.\*A
- d) Y=Q (1:4)
- e) Z=Q (3: end)
- f) T=max (Q)
- g) S= [A.\*B zeros (3); B A\*B]
- h) V= [A ones (3); eye (3) A-B]

**Question5: (10 Marks)**

Design a machine tool speed gear box such as shown in figure (3) using a Matlab program.

The inputs and outputs of the program should be as follows:

Inputs	Outputs
Number of speeds (n)	Minimum number of Shafts
Maximum and minimum speed values Nmax , and Nmin	Number of two and three Sliding Blocks
	Minimum number of Sliding gears
Speed distribution (Geometric) $C=(Nmax / Nmin)^{(1 / (n - 1))}$	Minimum number of Fixed gears
	Speed Values (N1=Nmin, N2,....., Nmax)

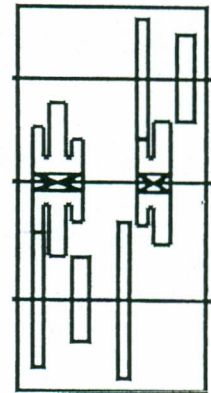


Figure (3)

**Question6: (10Marks)**

1-What is the purpose of each of the following MATLAB functions:

- a) clf
- b) clc
- c) clear
- d) who

2-Compare between the following MATLAB commands using the values (-1.1 -3.9 1.1 3.9) :

- a) ceil
- b) floor
- c) round
- d) fix

**Question 7: [10Marks]**

The table below shows the final course grade and its corresponding relevant letter grade.

Letter grade	Final course grade
A	90 < grade ≤ 100
B	80 < grade ≤ 90
C	70 < grade ≤ 80
D	60 < grade ≤ 70
F	grade ≤ 60

For the course grades: 70, 85, 90, 97, 50, 60, 71, 83, 91, 86, 77, 45, 67, 88, 64, 79, 75,

Design a MATLAB program to determine the number of students who attained each grade from A till F, and to calculate the mean grade of all students?



**Question 8: [10Marks]**

Design 3 different small Matlab programs from your own mind, so that:

Program 1 includes "while" loop statement.

Program 2 includes "switch-case" statement.

Program 3 includes "if...elseif...else...end" statement.

**Question 9: [10Marks]**

Design MATLAB programs to construct graphs of figure (4) with all its details:

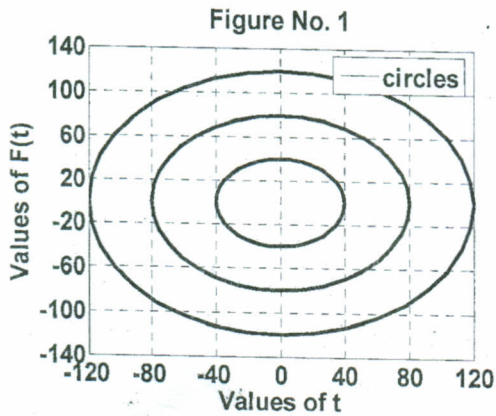
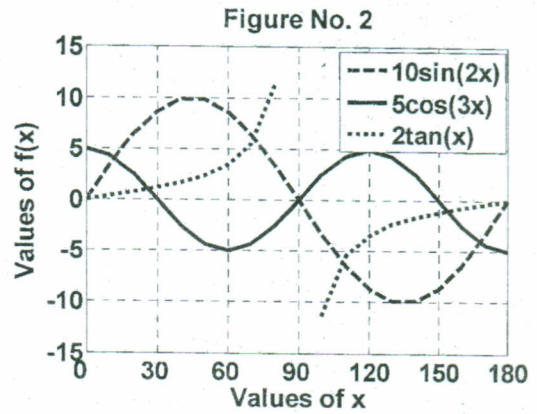


Figure (4)



**Question 10: [10Marks]**

Design a MATLAB program that calculates the shaft diameter shown in figure (5). The shaft carries a gear which is subjected to a vertical force  $F=1000$  N and a torque  $T=100$  N.m. The allowable shear stress  $\tau_{all}=40$  MPa. [Neglect any other effects].

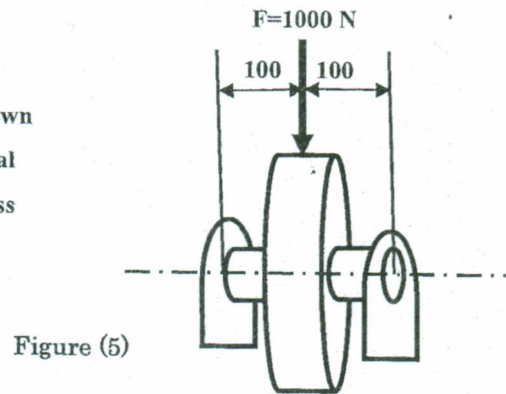


Figure (5)

Good Luck,  
Dr. Ahmed Galal