Problem 2:

e)

MATLAB code:

```
A=2.016;
zeta= 0.125;
wn=2;
wd=1.984;
phi=1.4455;
t=[0:0.1:25];
n=length(t);
x= zeros (1, n);
for k=1: n
    x(k)=A*exp(-zeta*wn*t(k)) *sin(wd*t(k)+phi);
end
plot (t, x)
grid on
xlabel('Time(s)')
ylabel('X(m)')
```

The output graph:

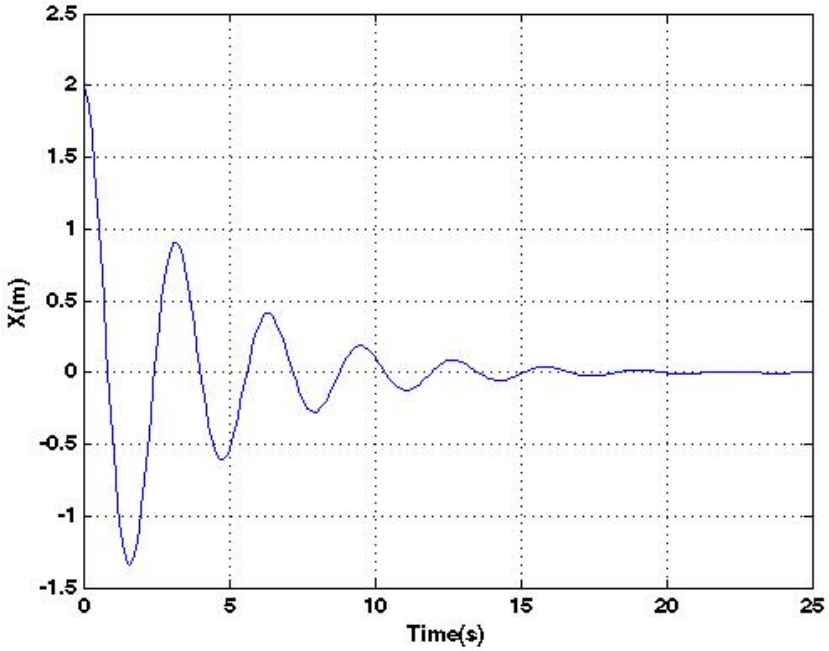


Figure 1: System's response

Problem 4:

a) MATLAB code:

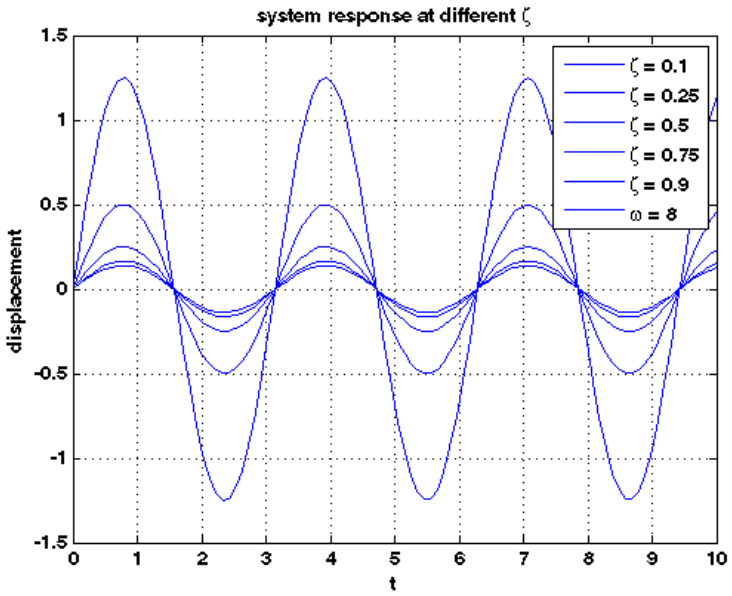
```
w=2;
wn=2;
fo =1;
tf = 10;
t= linspace(0,tf,100);
zeta=[0.1,0.25,0.5,0.75,0.9];
col = ['b','k','r','g','y'];
for i= 1:length(zeta)

    wd(i) = wn^2*(1-zeta(i)^2)^0.5;
    theta(i) = atan((2*zeta(i)*wn*w)/(wn^2-w^2));
    X(i) = fo/((wn^2-w^2)^2+(2*zeta(i)*wn*w)^2)^0.5;

    for j = 1:length(t)
        x(i,j) = X(i)*cos(w*t(j)-theta(i));
    end
end

figure
for k = 1:length(zeta)
    name{k}= ['\zeta = ' num2str(zeta(k))];
    h(k)= plot (t, x(k,:));
    hold on
end
grid on
legend (h,name);
xlabel('t')
ylabel ('displacement')
title ('system response at different \zeta')
```

The output graph:



b) MATLAB code:

```
wn=2;
w=[0.1,0.5,1,2,4,8];
zeta = 0.2;
fo =1;
tf = 1;
t= linspace(0,tf,100);
col = ['b','k','r','g','y'];
for i= 1:length(w)
    theta(i) = atan((2*zeta*wn*w(i))/(wn^2-w(i)^2));
    X(i) = fo/((wn^2-w(i)^2)^2+(2*zeta*wn*w(i))^2)^0.5;
    for j = 1:length(t)
        x(i,j) = X(i)*cos(w(i)*t(j)-theta(i));
    end
end

figure
for k = 1:length(w)
    name{k}= ['\omega = ' num2str(w(k))];
    h(k)= plot (t, x(k,:));
    hold on
end
grid on
legend (h,name);
xlabel('t')
ylabel ('displacement')
title ('system response at different \Omega')
```

The output graph: