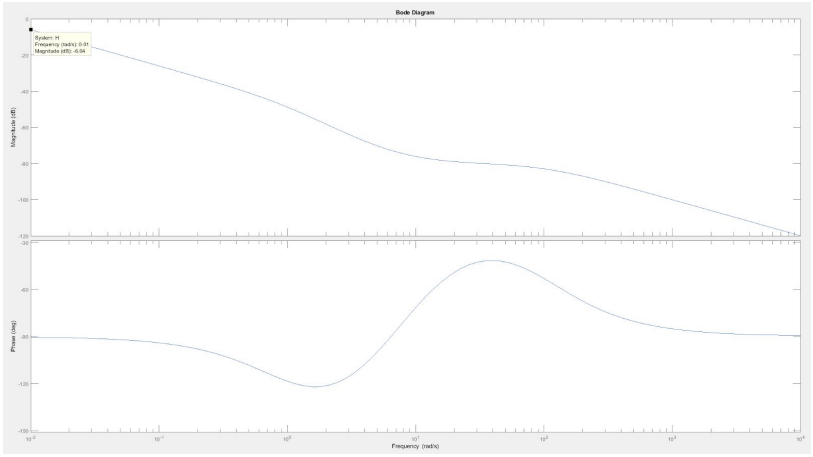
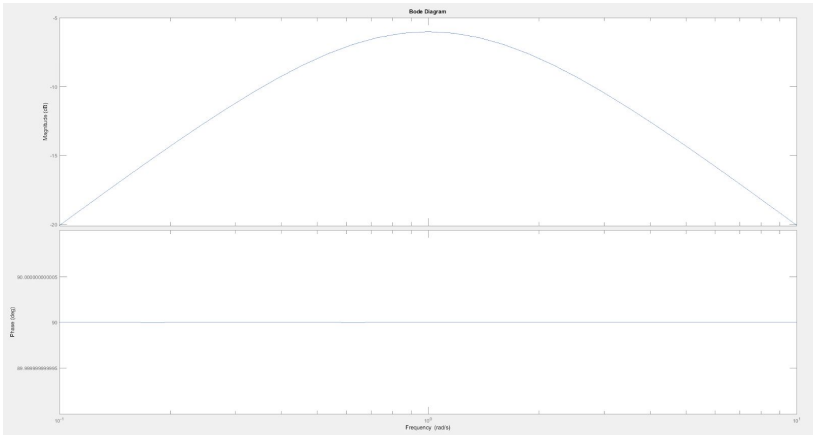
1.

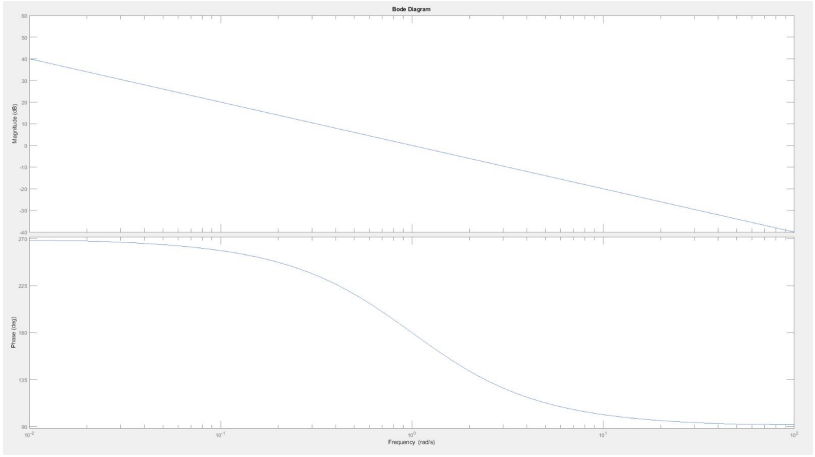
a.


Bode Diagram
System: H
Frequency (rad/s): 0.01
Magnitude (dB): -5.94
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

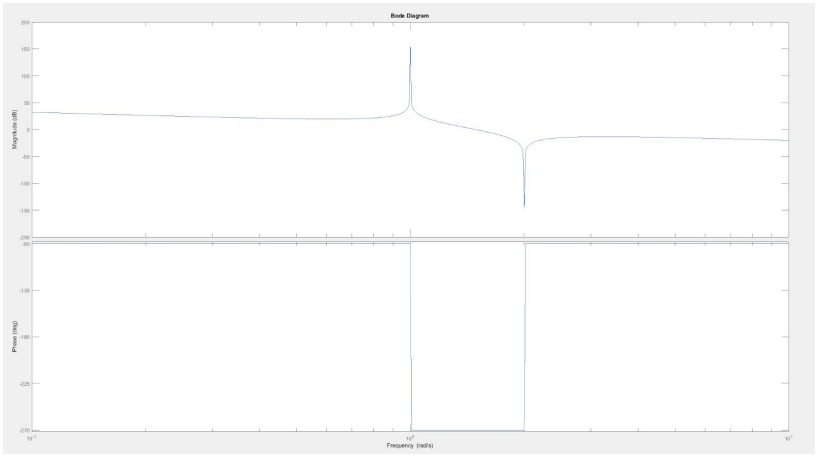
b.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

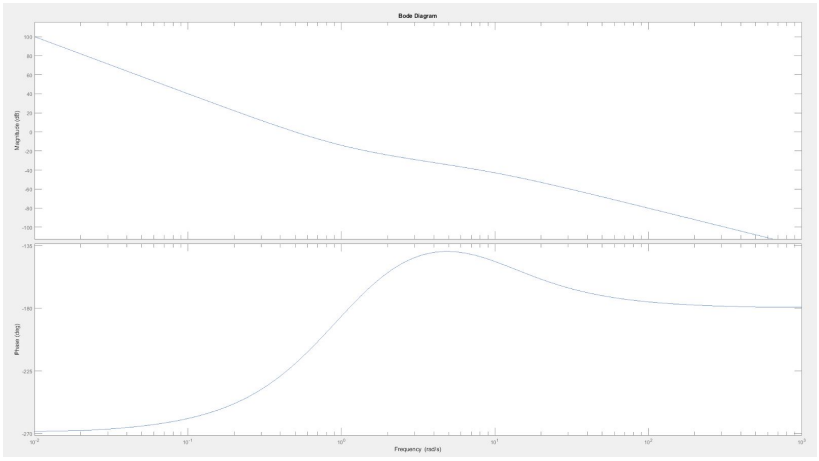
c.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

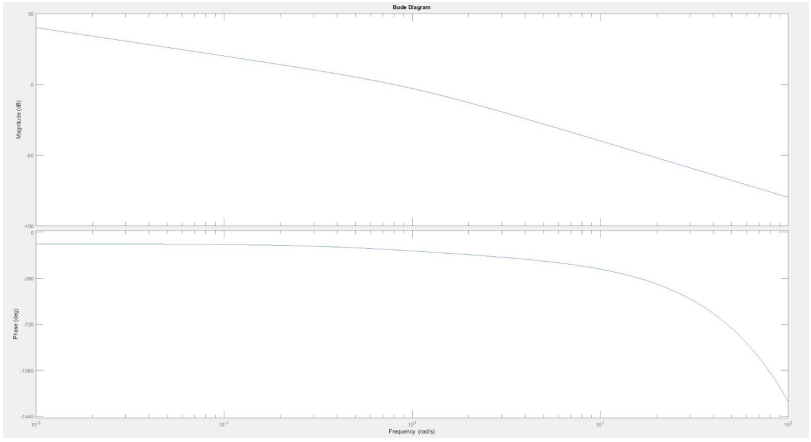
d.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

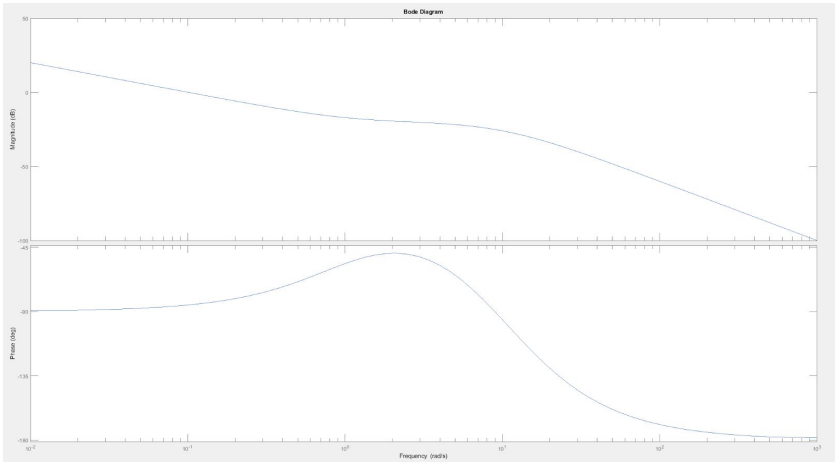
e.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

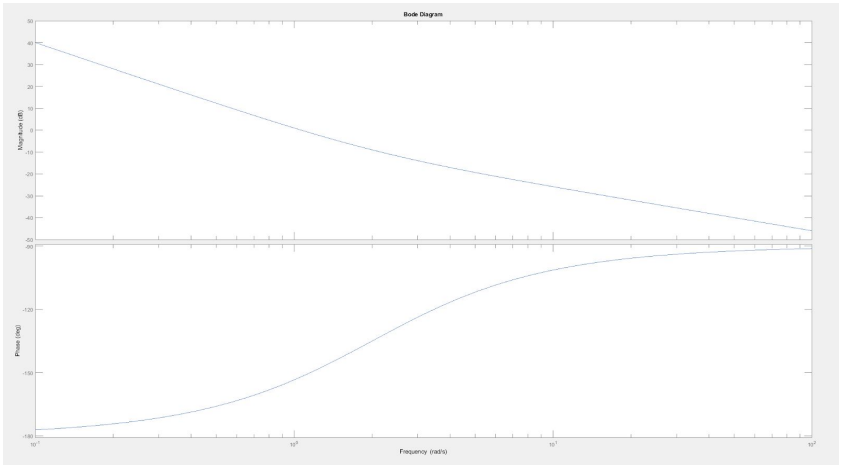
f.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

g.


Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

h.

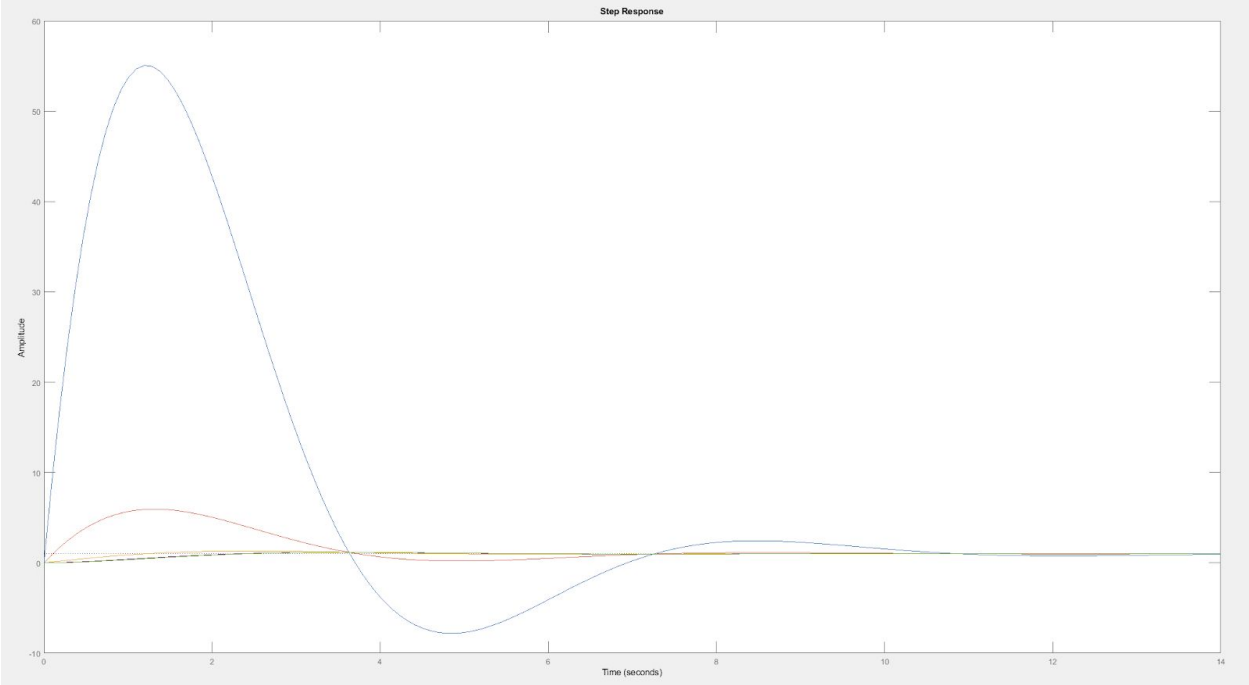

Bode Diagram
Magnitude (dB)
Phase (deg)
Frequency (rad/s)

2.

```
>> L1 = (s/0.01+1)/(s^2+s+1);
>> L2 = (s/0.1+1)/(s^2+s+1);
>> L3 = (s/1+1)/(s^2+s+1);
>> L4 = (s/10+1)/(s^2+s+1);
>> L5 = (s/100+1)/(s^2+s+1);
```

a)

```
>> hold on;
>> step(L1);
>> step(L2);
>> step(L3);
>> step(L4);
>> step(L5);
>> hold off;
```



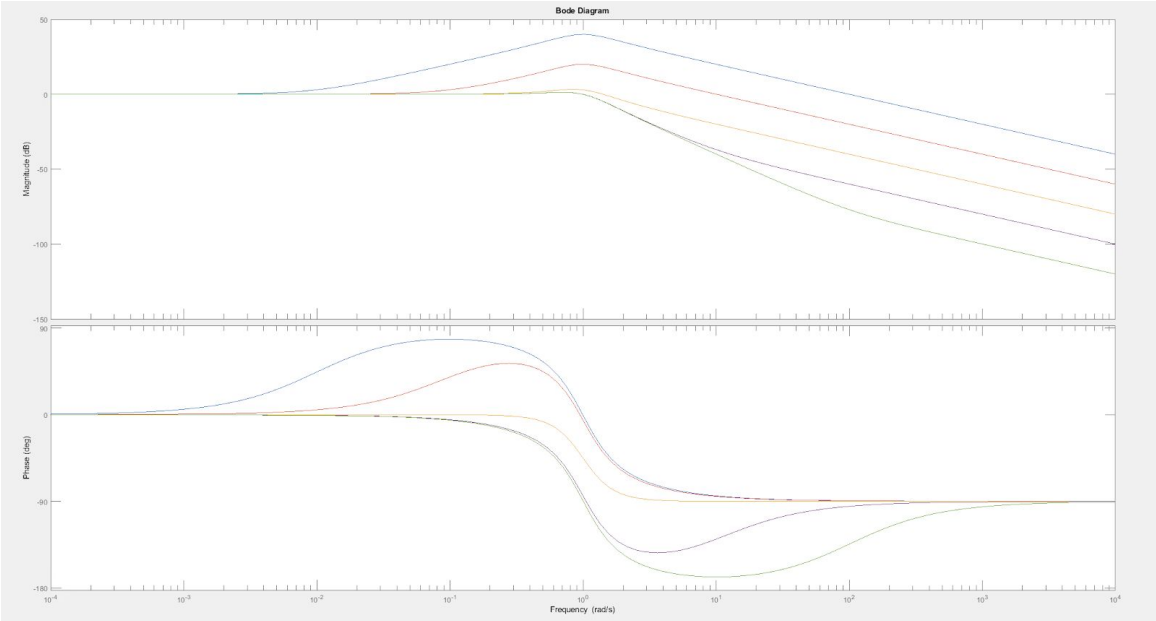
b)

```
>> stepinfo(L1)

ans =

  struct with fields:

        RiseTime: 0.0084
    SettlingTime: 9.2958
     SettlingMin: -7.8126
     SettlingMax: 55.0727
       Overshoot: 5.4073e+03
      Undershoot: 781.2564
            Peak: 55.0727
        PeakTime: 1.1973

>> stepinfo(L2)

ans =

  struct with fields:

        RiseTime: 0.0836
    SettlingTime: 9.3909
     SettlingMin: 0.1942
     SettlingMax: 5.9433
       Overshoot: 494.3310
      Undershoot: 0
            Peak: 5.9433
        PeakTime: 1.2894

>> stepinfo(L3)

ans =

  struct with fields:

        RiseTime: 0.9409
    SettlingTime: 7.5054
     SettlingMin: 0.9403
     SettlingMax: 1.2984
       Overshoot: 29.8352
      Undershoot: 0
```

```
           Peak: 1.2984
       PeakTime: 2.3947

>> stepinfo(L4)

ans =

  struct with fields:

       RiseTime: 1.6275
   SettlingTime: 7.9789
    SettlingMin: 0.9016
    SettlingMax: 1.1639
     Overshoot: 16.3862
    Undershoot: 0
           Peak: 1.1639
       PeakTime: 3.4999

>> stepinfo(L5)

ans =

  struct with fields:

       RiseTime: 1.6384
   SettlingTime: 8.0658
    SettlingMin: 0.9010
    SettlingMax: 1.1630
     Overshoot: 16.2988
    Undershoot: 0
           Peak: 1.1630
       PeakTime: 3.5920
```

c)

```
>> hold on;
>> bode(L1);
>> bode(L2);
>> bode(L3);
>> bode(L4);
>> bode(L5);
>> hold off;
```



d)

```
>> a = getPeakGain(L1);
>> b = getPeakGain(L2);
>> c = getPeakGain(L3);
>> d = getPeakGain(L4);
>> e = getPeakGain(L5);
>> a

a =

  100.0050

>> b

b =

   10.0499
```

```
>> c

c =

    1.4676

>> d

d =

    1.1495

>> e

e =

    1.1547
```

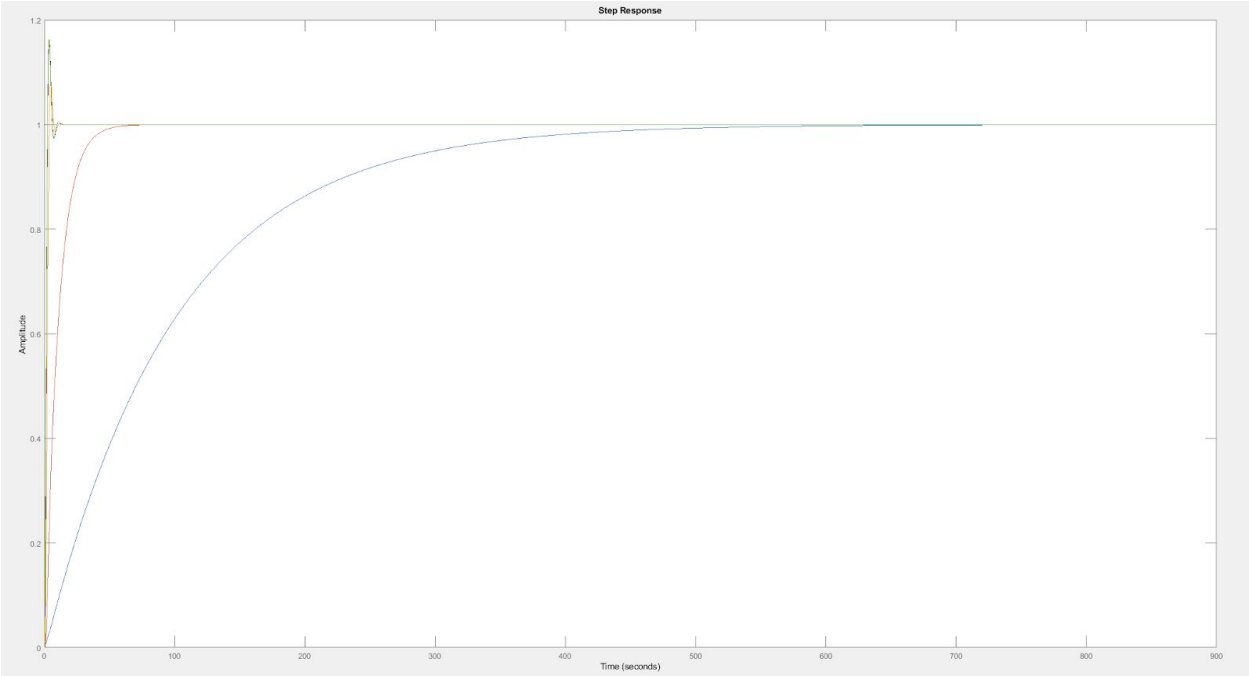
e) As the value of p is increased, the time response becomes more and more dampened.
As the value of p is increased, the frequency response lowers its resonant peak

3.

```
>> L1 = 1/((s/0.01+1)*(s^2+s+1));
>> L2 = 1/((s/0.1+1)*(s^2+s+1));
>> L3 = 1/((s/1+1)*(s^2+s+1));
>> L4 = 1/((s/10+1)*(s^2+s+1));
>> L5 = 1/((s/100+1)*(s^2+s+1));
```

a)

```
>> hold on;
>> step(L1);
>> step(L2);
>> step(L3);
>> step(L4);
>> step(L5);
>> hold off;
```



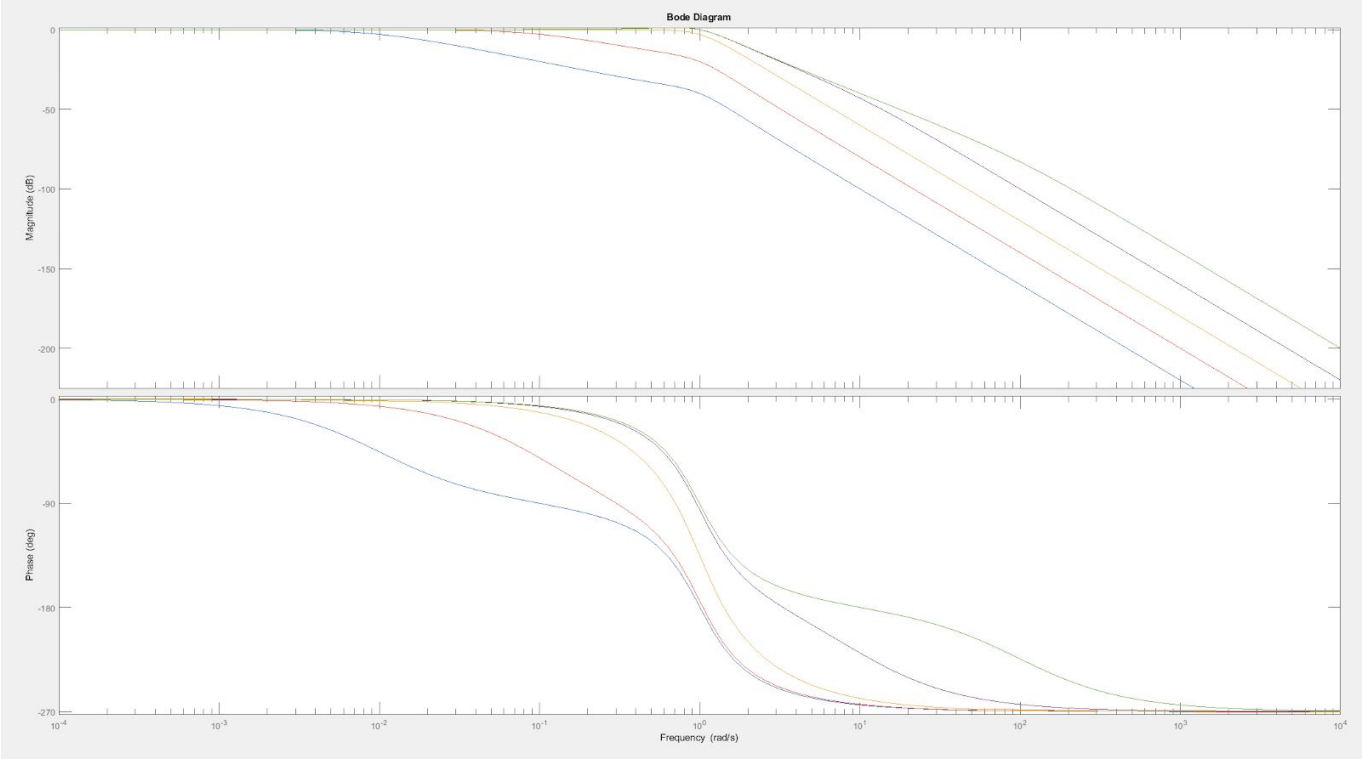
b)

```
>> a = stepinfo(L1);
>> b = stepinfo(L2);
>> c = stepinfo(L3);
>> d = stepinfo(L4);
>> e = stepinfo(L5);
>> a

a =

  struct with fields:

        RiseTime: 219.7108
    SettlingTime: 392.2119
     SettlingMin: 0.9035
     SettlingMax: 1.0000
       Overshoot: 0
      Undershoot: 0
            Peak: 1.0000
        PeakTime: 1.0546e+03

>> b

b =

  struct with fields:

        RiseTime: 21.6004
    SettlingTime: 40.0638
     SettlingMin: 0.9016
     SettlingMax: 0.9996
       Overshoot: 0
      Undershoot: 0
            Peak: 0.9996
        PeakTime: 79.0247

>> c

c =

  struct with fields:

        RiseTime: 2.2911
```

```
    SettlingTime: 6.6376
     SettlingMin: 0.9050
     SettlingMax: 1.0814
       Overshoot: 8.1391
      Undershoot: 0
            Peak: 1.0814
        PeakTime: 4.8815

>> d

d =

  struct with fields:

        RiseTime: 1.6510
    SettlingTime: 8.1728
     SettlingMin: 0.9273
     SettlingMax: 1.1620
       Overshoot: 16.2014
      Undershoot: 0
            Peak: 1.1620
        PeakTime: 3.7762

>> e

e =

  struct with fields:

        RiseTime: 1.6396
    SettlingTime: 8.0860
     SettlingMin: 0.9279
     SettlingMax: 1.1629
       Overshoot: 16.2853
      Undershoot: 0
            Peak: 1.1629
        PeakTime: 3.5920
```

c)

```
>> hold on;
>> bode(L1);
>> bode(L2);
>> bode(L3);
>> bode(L4);
>> bode(L5);
>> hold off;
```



d)

```
>> a = getPeakGain(L1);
>> b = getPeakGain(L2);
>> c = getPeakGain(L3);
>> d = getPeakGain(L4);
>> e = getPeakGain(L5);
>> a

a =

    1.0000
```

```
>> b

b =

     1

>> c

c =

     1

>> d

d =

   1.1518

>> e

e =

   1.1547
```

e) As the value of p is increased, the time response of the system becomes less and less damped.

As the value of p approaches 1, the frequency response of the system becomes more regular.

4.

```
>> R = 100000

R =

      100000

>> C = 1/(s*2*10^-6)

C =

     1
  -------
  2e-06 s

Continuous-time transfer function.

>> Z1 = R+C

Z1 =

  0.2 s + 1
  ---------
   2e-06 s

Continuous-time transfer function.

>> Z2 = R+((R*C)/(R+C))

Z2 =

   0.04 s^2 + 0.4 s
  ------------------
  4e-07 s^2 + 2e-06 s

Continuous-time transfer function.

>> H = -Z2/Z1

H =

     -8e-08 s^3 - 8e-07 s^2
  -------------------------------
```

8e-08 s^3 + 8e-07 s^2 + 2e-06 s

Continuous-time transfer function.

>> bode(H)