KATHMANDU UNIVERSITY

SCHOOL OF ENGINEERING

DHULIKHEL

PCEG-308

Lab -04

Frequency Response Plots

Department of Electrical and Electronics Engineering

By:

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To:

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Bode Plot

Obtain the bode plot of the system whose open loop transfer function is given as below:

$$G(s)H(s) = \frac{200(s+3)}{s(s+2)(s^2+4s+100)}$$

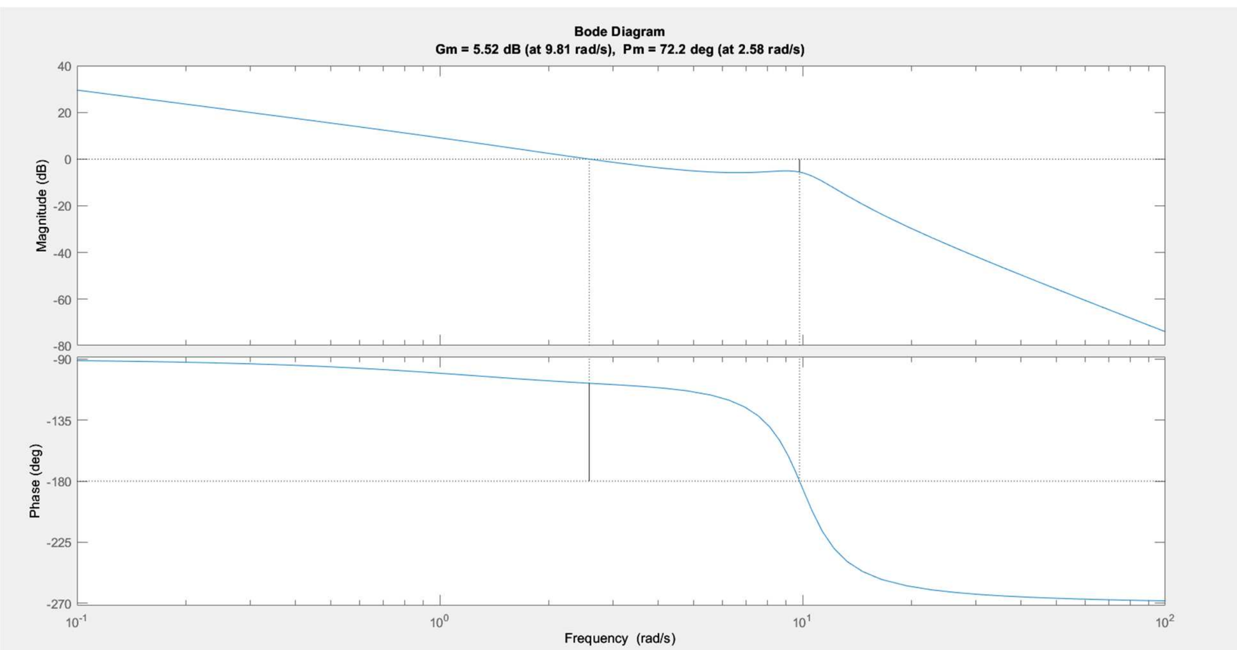
Matlab Code:

```
>> n = [200 600];
>> d = conv([1 2 0], [1 4 100]);
>> bode(n, d);
>> grid;
```

MATLAB Code to find gain margin and phase margin

```
>> [Gm, Pm, pcf, gcf] = margin(n, d)

Gm = 1.8870
Pm = 72.1660
pcf =  9.8099
gcf =  2.5813
```



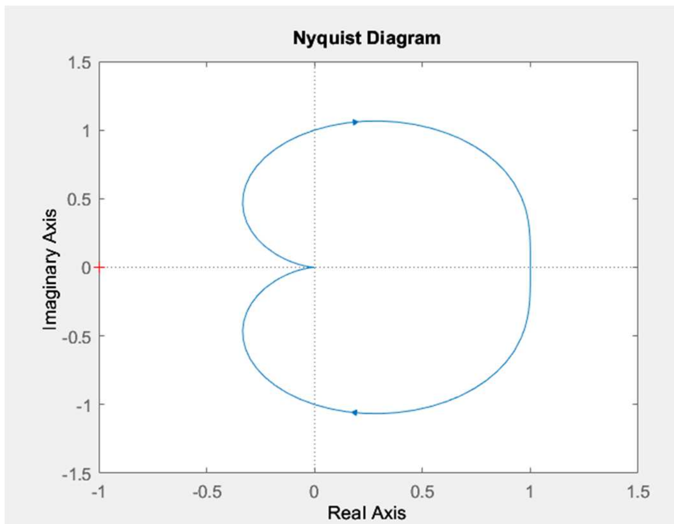
Nyquist Plot

Draw the nyquist plot for the following open loop transfer function

$$G(s)H(s) = \frac{1}{(s^2+s+1)}$$

Matlab Code:

```
>> n = [1];
>> d = [1 1 1];
>> grid;
>> nyquist(n,d);
```



Nichols chart

Draw the Nichols chart for the following transfer function

$$G(s)H(s) = \frac{10(s+1)}{(s^3 + 7s^2 + 10s + 6)}$$

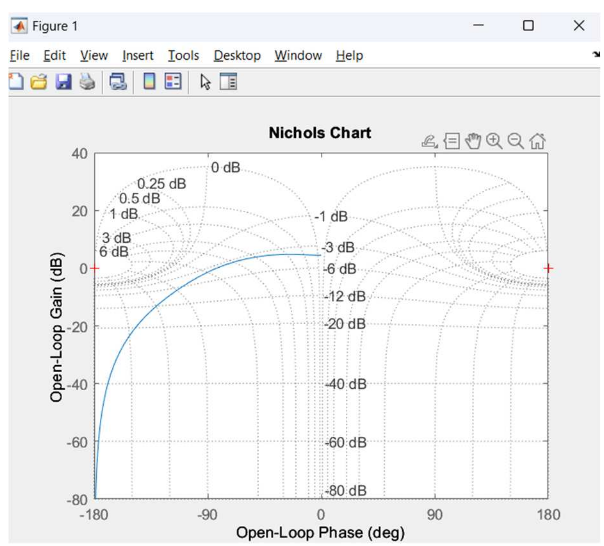
Matlab Code:

```
>> n = [10 10];

>> d = [1 7 10 6];

>> nichols(n,d);

>> grid;
```



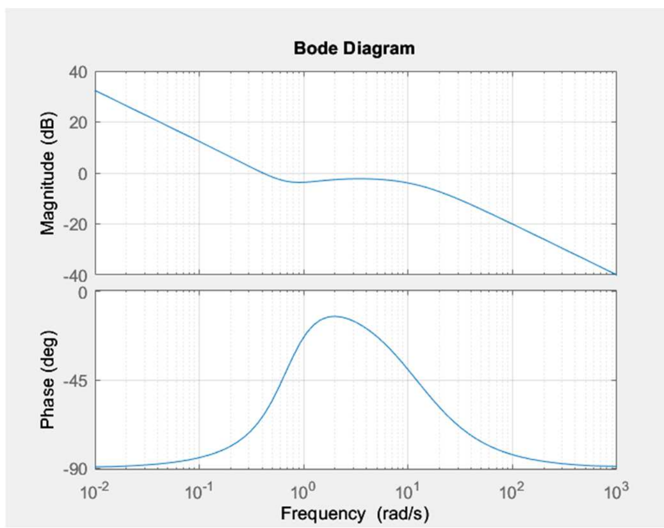
Exercises:

1) **Obtain the Bode-plot of the system whose open loop transfer function is given below, also find the Gain margin and phase margin**

a) **G(s)H(s) =** $\frac{10(s^2+s+0.5)}{(s)(s+1)(s+12)}$

Matlab Code:

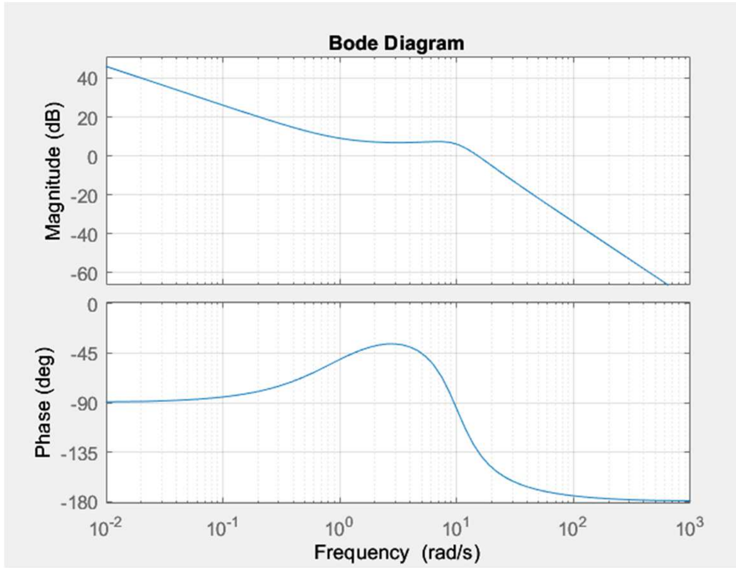
```
>> n = [10 10 5];
>> d = conv([1 0], conv( [1 1], [1 12]));
>> bode(n, d);
>> grid;
>> [Gm, Pm, pcf, gcf] = margin(n, d)
        Gm =   Inf
        Pm =  116.4492
        pcf =   NaN
        gcf =   0.4063
```



b) **G(s)H(s) =** $\frac{200(s+1)}{(s)(s^2+10s+100)}$

Matlab Code:

```
>> n = [200 200];
>> d = [1 10 100 0];
>> bode(n, d);
>> grid;
>> [Gm, Pm, pcf, gcf] = margin(n, d)
```

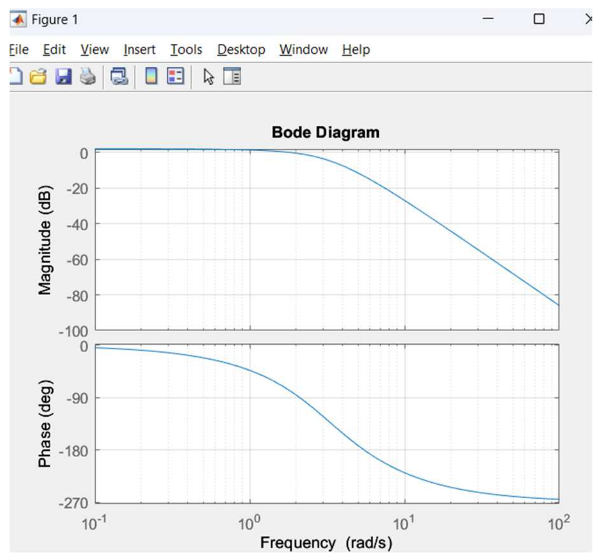


c) **G(s)H(s) =** $\frac{50}{(s^3+9s^2+30s+40)}$

Matlab Code:

```
>> n = [50];
>> d = [1 9 30 40];
>> bode(n, d);
>> grid;
>> [Gm, Pm, pcf, gcf] = margin(n, d)

Gm =    4.6019
Pm =  100.6674
pcf =    5.4782
gcf =    1.8483
```



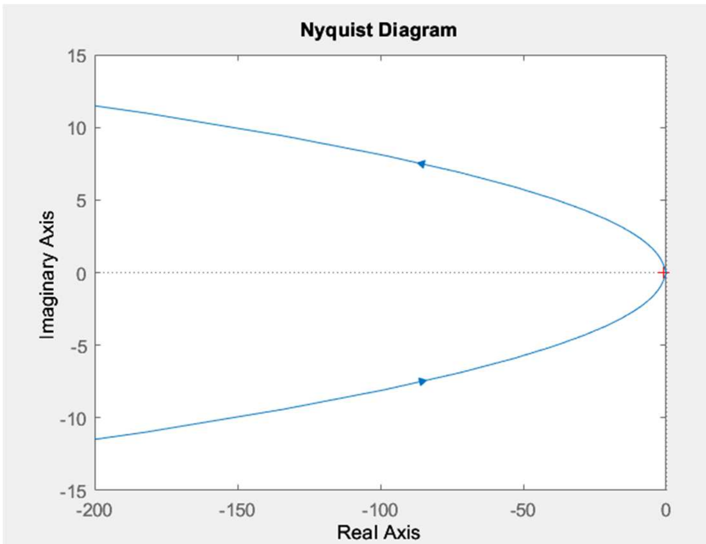
2) Draw the Nyquist Plot and Nichols chart for the following open loop transfer function.

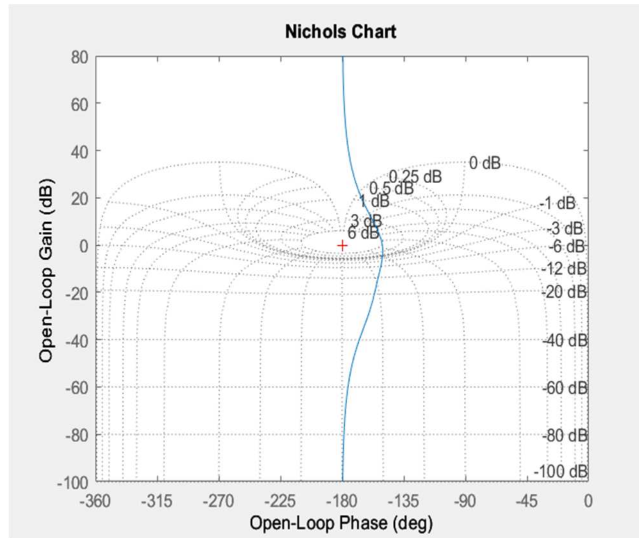
a) **G(s)H(s) =** $\frac{100(s+4)(s+32)}{s^3(s+50)(s+10)}$

Matlab Code:

```
n = 100 * [1 36 128];
d = [1 60 500 0 0];
grid;
nyquist(n, d);
```

```
nichols(n,d);
grid on;
```

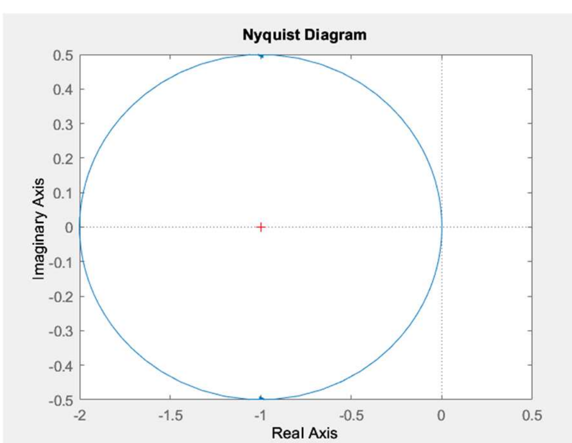


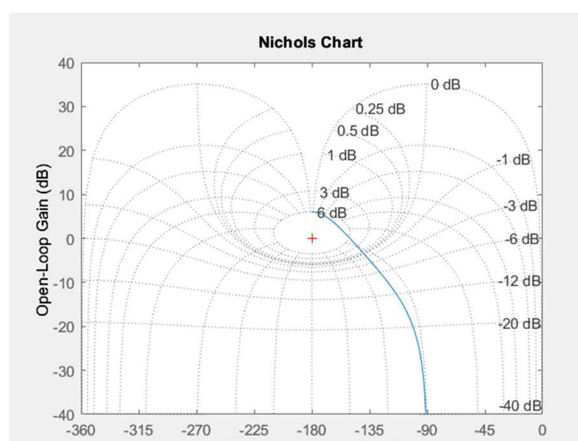


b) **G(s)H(s) =** $\frac{(s+2)}{s^2-1}$

Matlab Code:

```
>> n = [1 2];
>> d = [1 0 -1];
>> grid;
>> nyquist(n,d);
>> nichols(n,d);
>> grid on;
```





c) **G(s)H(s) =** $\frac{10(0.5s+1)(s+2)}{(5s+1)(s-2)}$

Matlab Code:

```
n = 10 * [0.5 2.5 2];
d = [5 -9 2];
grid;
nyquist(n, d);
```