EE387: Signal Processing
Lab 4: Filter Design using MATLAB

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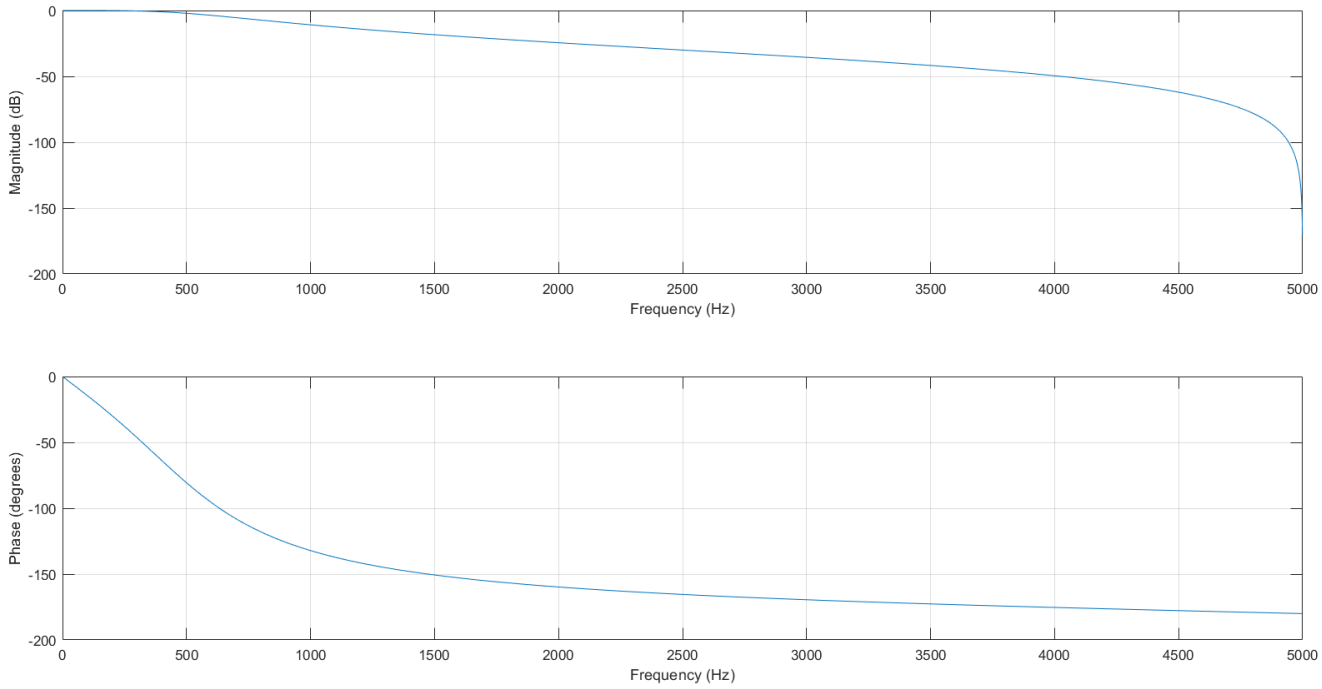
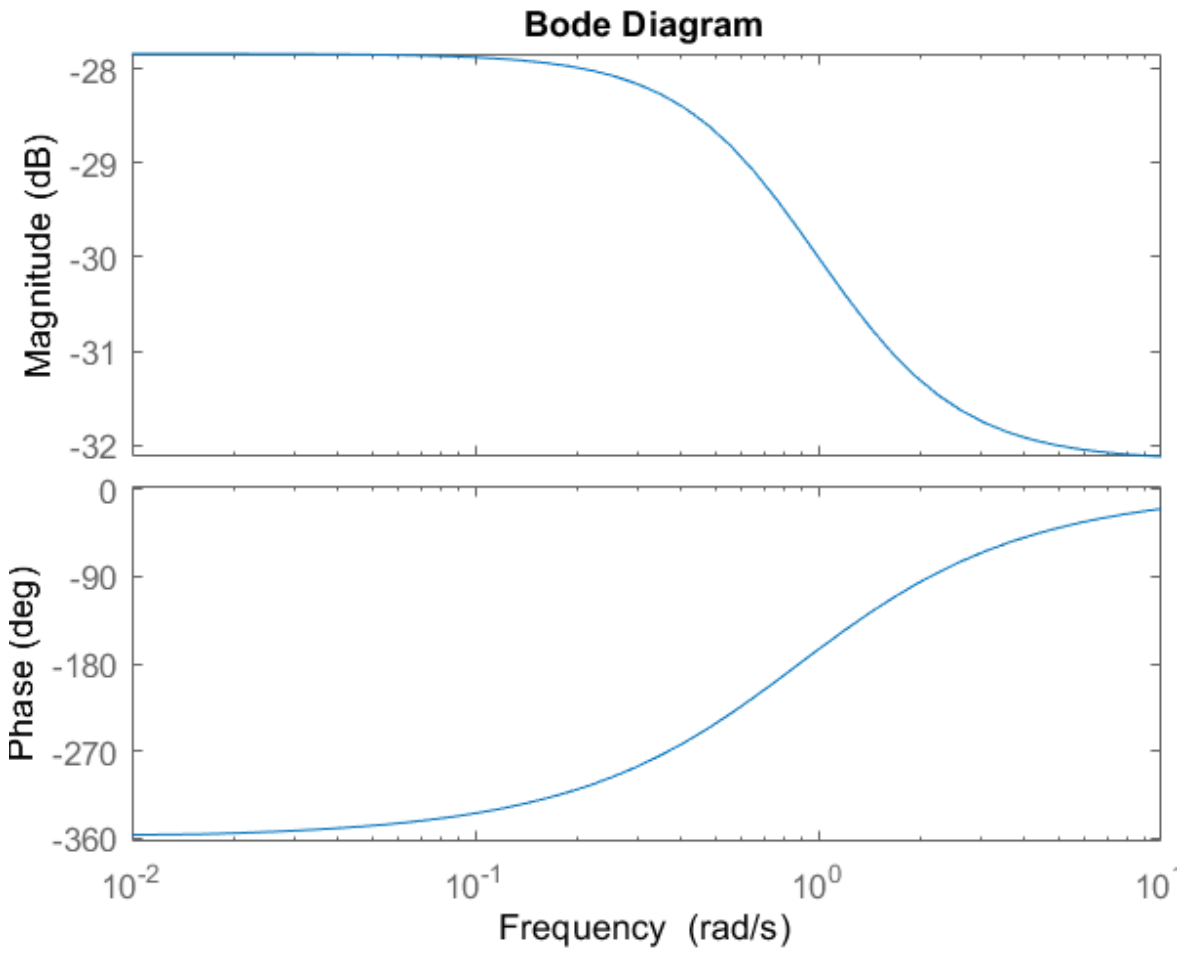
1. Design the Butterworth filter with the following specifications: Fp = 1000 Hz; Fs = 5000 Hz;

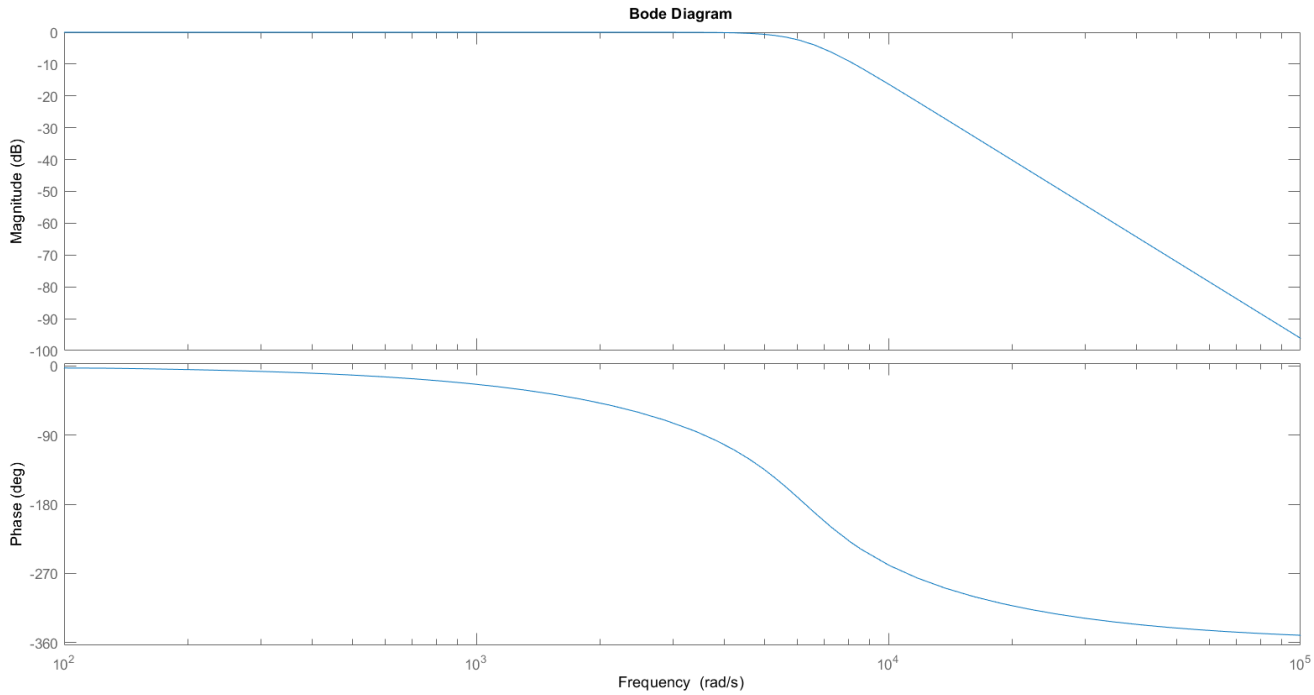
```
clear all;

Fp = 1000; Fs = 5000; Fsample = 10000;

Wp=Fp/Fsample;
Ws=Fs/Fsample;

[N,Wn]=buttord(Wp,Ws,3,30);
[zeros_,poles_,scale_]=butter(N,Wn);
[num,den]=butter(N,Wn);

tf=zpk(zeros_,poles_,scale_);
bode(tf);
figure;
freqz(num,den,5000,Fsample);
```





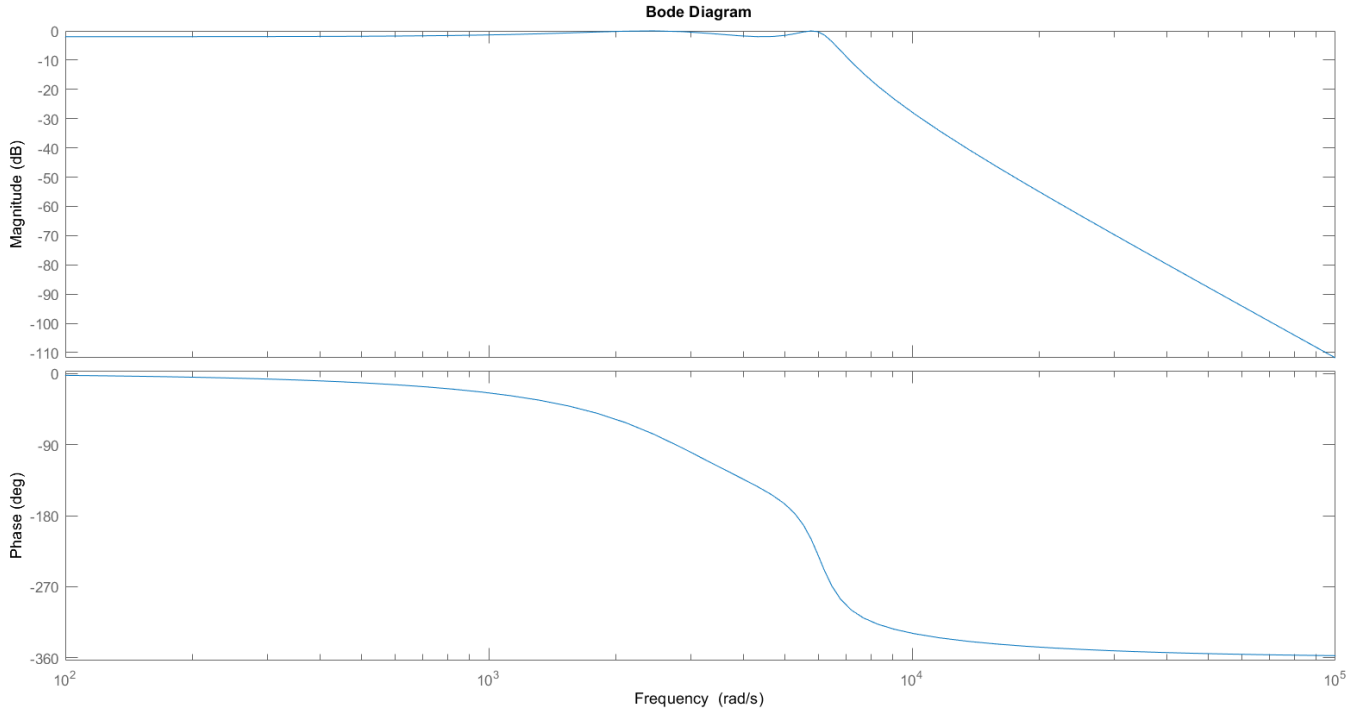
2. Design the Butterworth filter with Fp = 1000 Hz, N = 4.

```
clear all;
close all;

N=4;

Fp=1000;

Wp=2*pi*Fp;

[num,den]=butter(N,Wp,'s');
fil=tf(num,den);
bode(fil);
```



3. Design Chebyshev Type 1 filter with N = 4, Rp = 2 ; Fp = 1000.

```
clear all;
close all;

N=4;
Rp=2;
fp=1000;

Wp=2*pi*fp;

[num,den]=cheby1(N,Rp,Wp,'s');
fil=tf(num,den);
bode(fil);
```


Bode Diagram
Magnitude (dB)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
Phase (deg)
0
-90
-180
-270
-360
10^2
10^3
10^4
10^5
Frequency (rad/s)