EE387 – FILTER DESIGN USING MATLAB

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SEMESTER 06

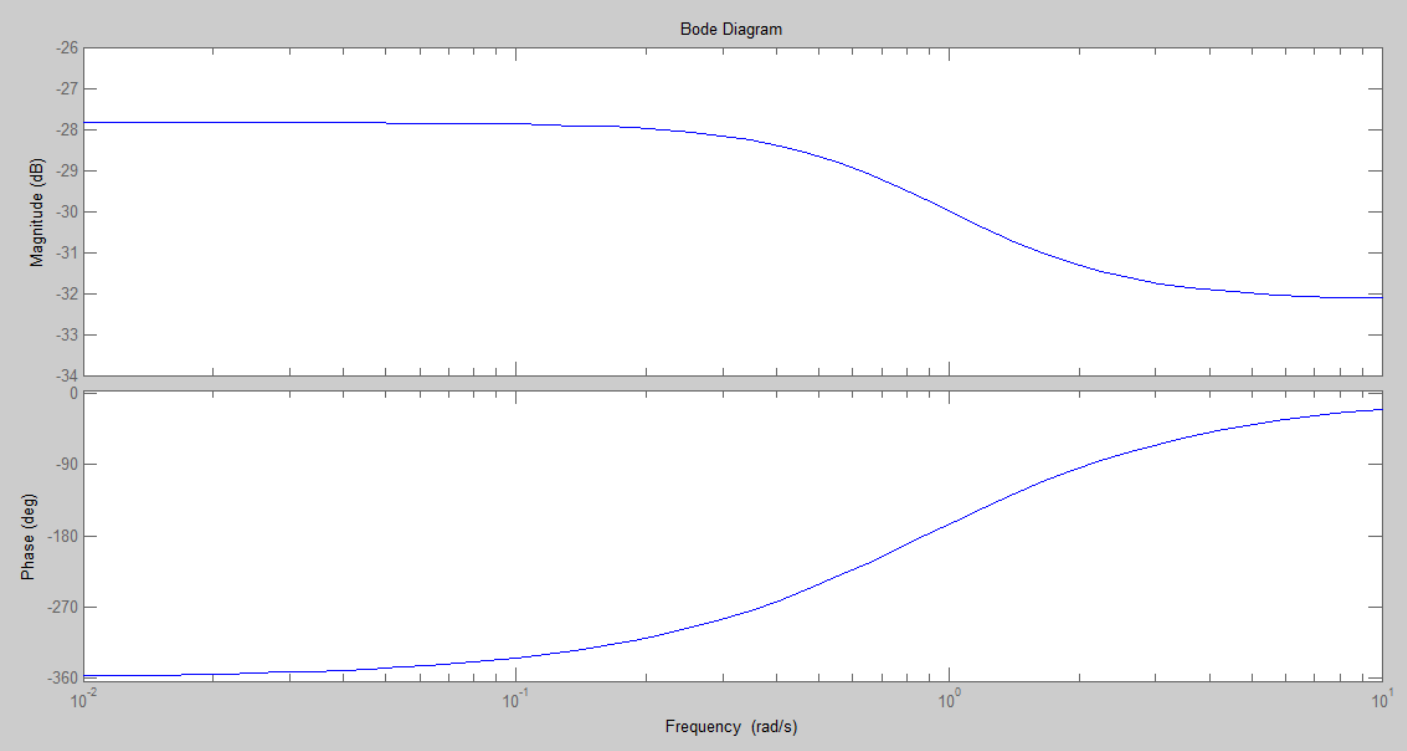
Exercises:

Use the above functions to design the following filters. Plot their Bode plots to verify the designs.

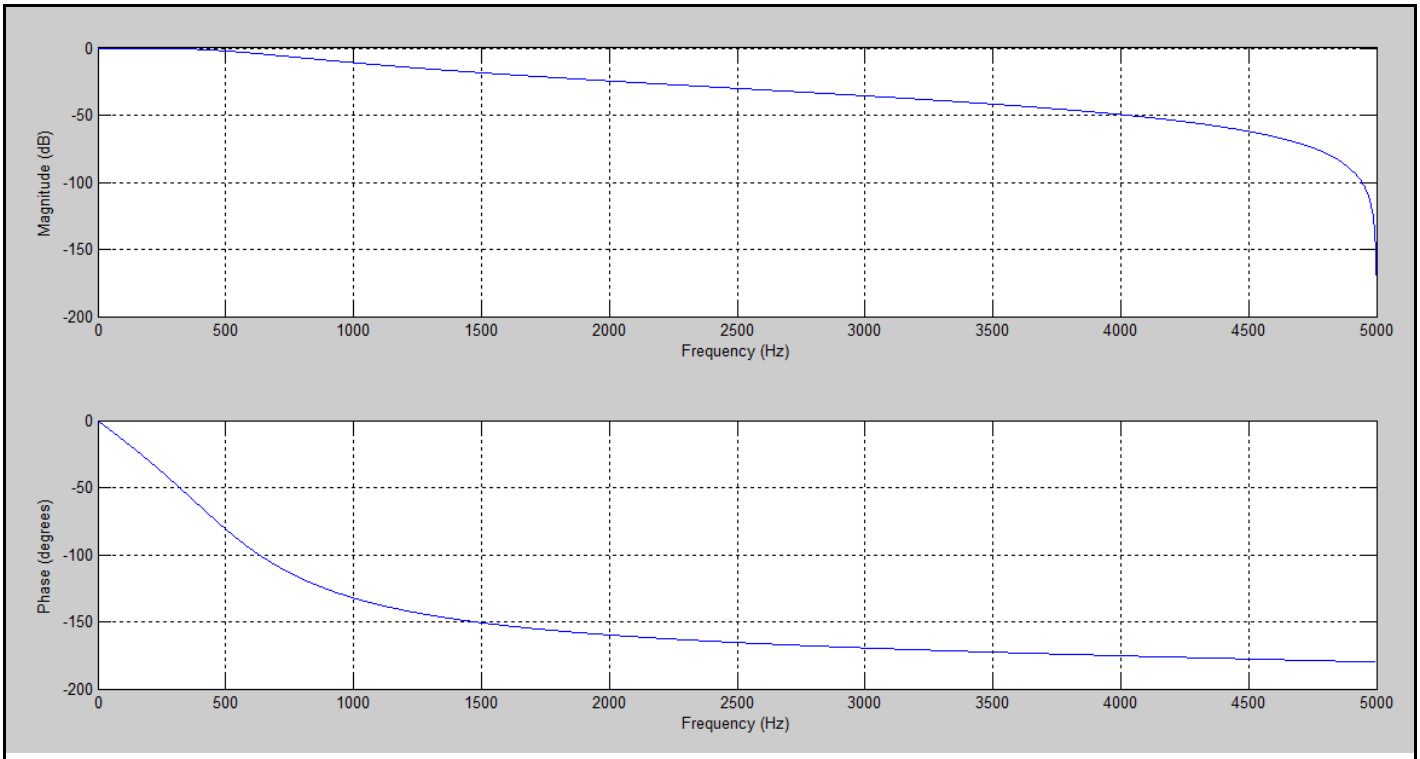
1. **Design the Butterworth filter with the following specifications: Fp = 1000 Hz; Fs = 5000 Hz;**

   Assumptions
   - This is a low pass filter
   - Sampling frequency is 10kHz

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

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

[N,Wn] = buttord(Wp,Ws,3,30);
[z,p,s] = butter(N,Wn);
[a,b] = butter(N,Wn);

filter = zpk(z,p,s);
bode(filter); % Bode diagram
```



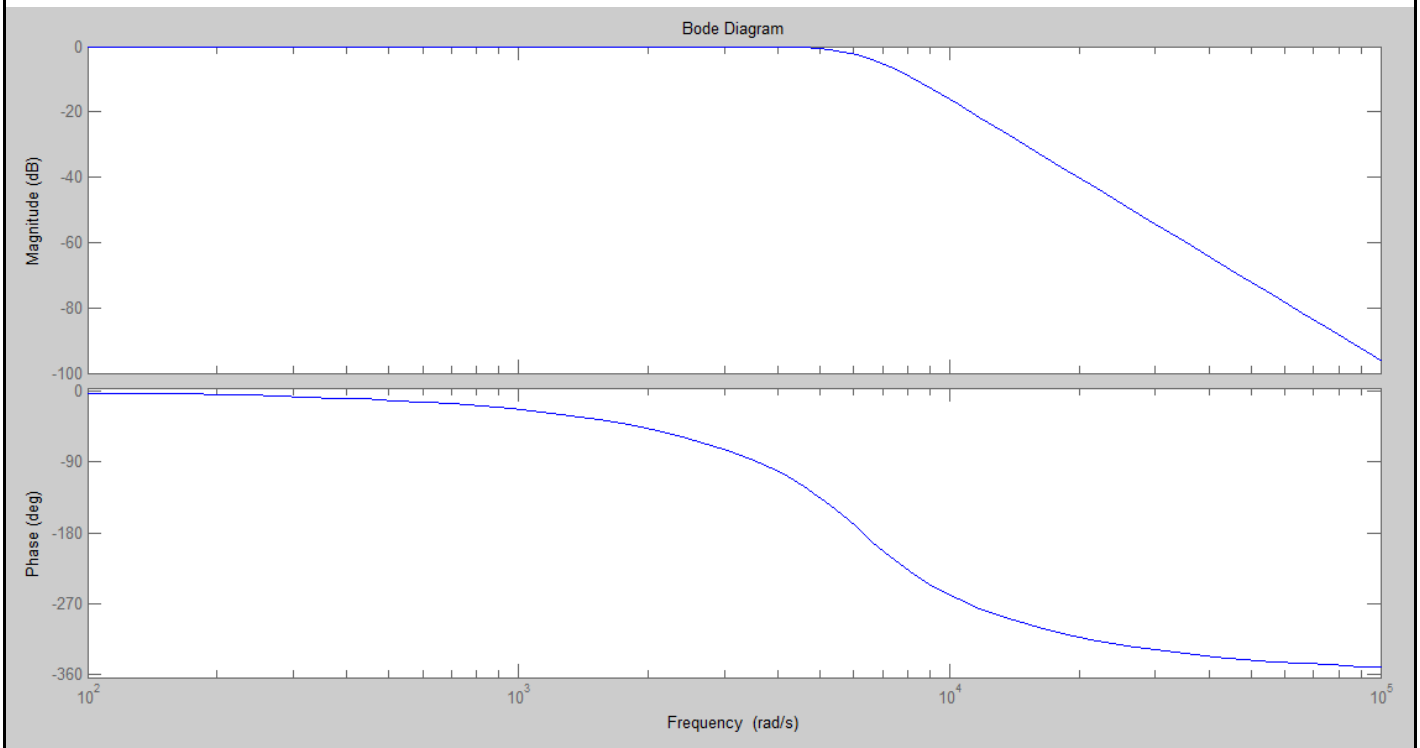

```
freqz(a,b,5000,Fsample); % frequency response
```



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

$F_p = 1000$
$W_n = 2\pi F_p = 2\pi \times 1000$

```
[num,den] = butter(4,2*pi*1000,'s');
filter = tf(num,den);
bode(filter);
```



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

$F_p = 1000$
$W_n = 2\pi F_p = 2\pi \times 1000$

```
[num,den] = cheby1(4,2,2*pi*1000,'s')
filter = tf(num,den);
bode(filter);
```