# Homework 4

1 Magnitude response for H1, H2, H3 are as follows.

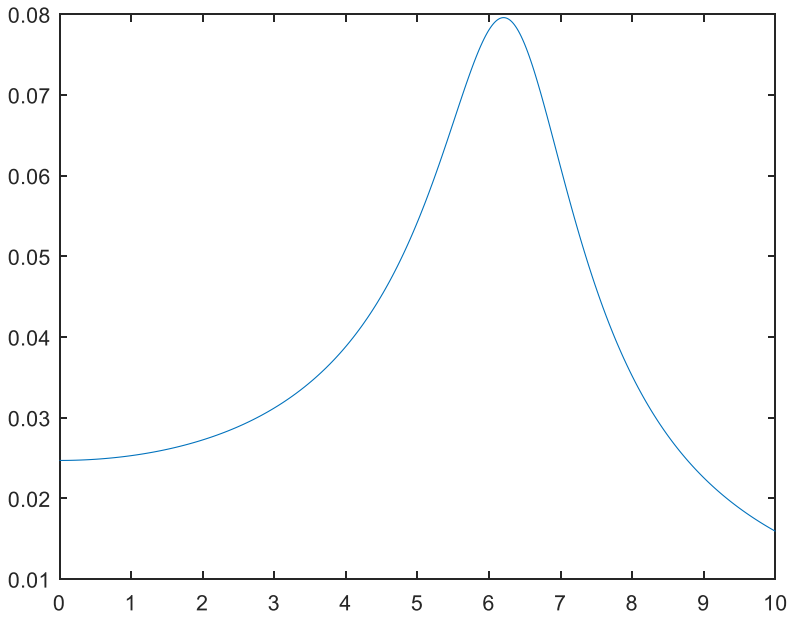



*Figure 1: H1(s) Notched Low Pass Filter*

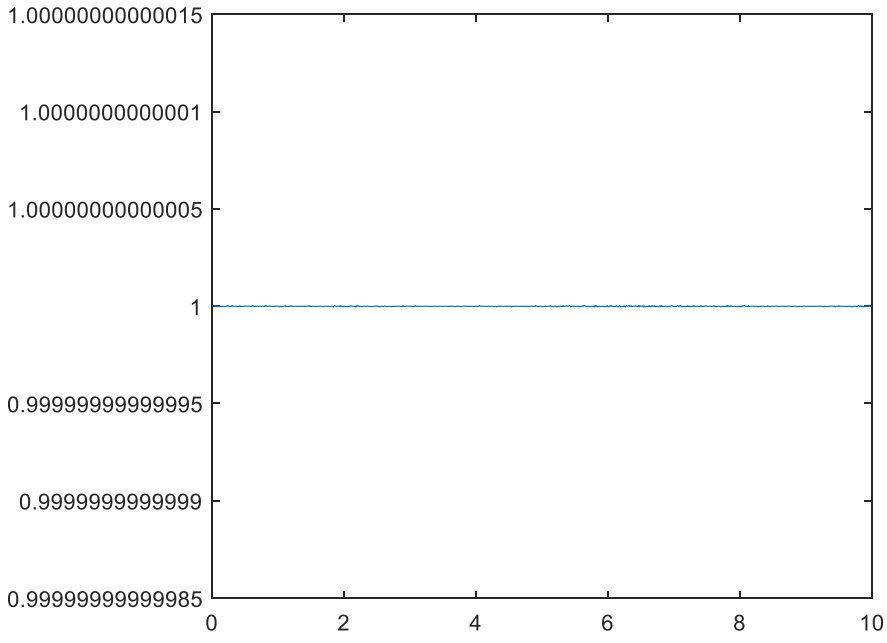



*Figure 2: H2(s) All-pass Filter*

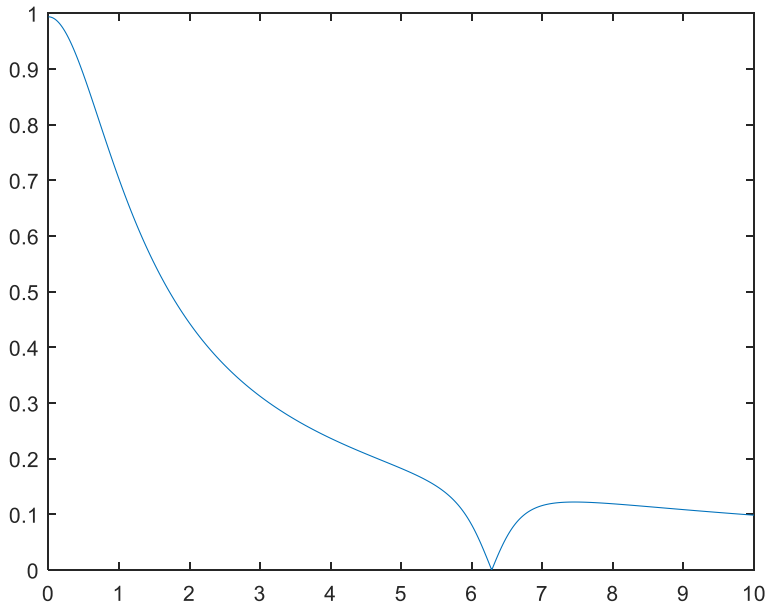


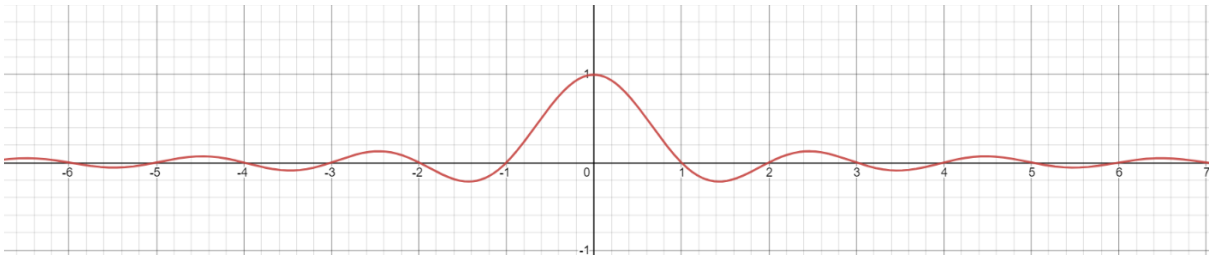

*Figure 3: H3(s) Low Pass Filter*

2

To find the impulse response we have the following:

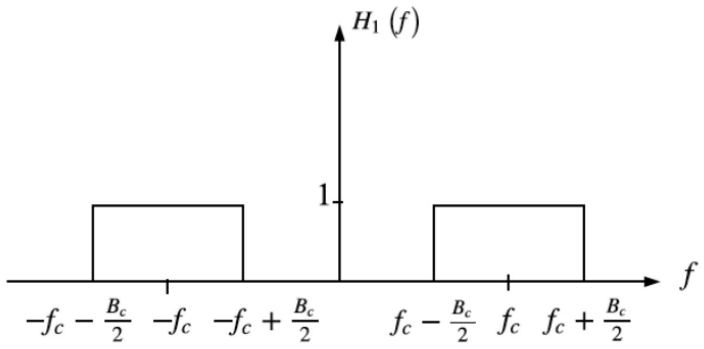
a)

$$h(t) = \frac{1}{2\pi}\int_{-\pi}^{\pi} 1e^{j\Omega t}\, d\Omega = \frac{1}{2\pi}\left[\frac{e^{j\Omega t}}{jt}\right]_{-\pi}^{\pi} = \frac{1}{2\pi}\frac{e^{\pi jt}-e^{-\pi jt}}{jt} = \frac{\mathbf{sin}\,(\pi \boldsymbol{t})}{\boldsymbol{\pi t}}$$




The function is non causal

b) When we shift the function the resulting graph looks as follows:




What looks like a band pass filter

3

a) $\frac{2.5-0.5}{2^{12}-1} = 0.0004884$
b) $\frac{2.3-0.5}{0.0004884} = 3685.5 = 3686$
c) $Number\ is\ ouside\ of\ range$ of voltage so the read would be 0
d) $\frac{2.9-0.5}{0.0004884} = 4914$

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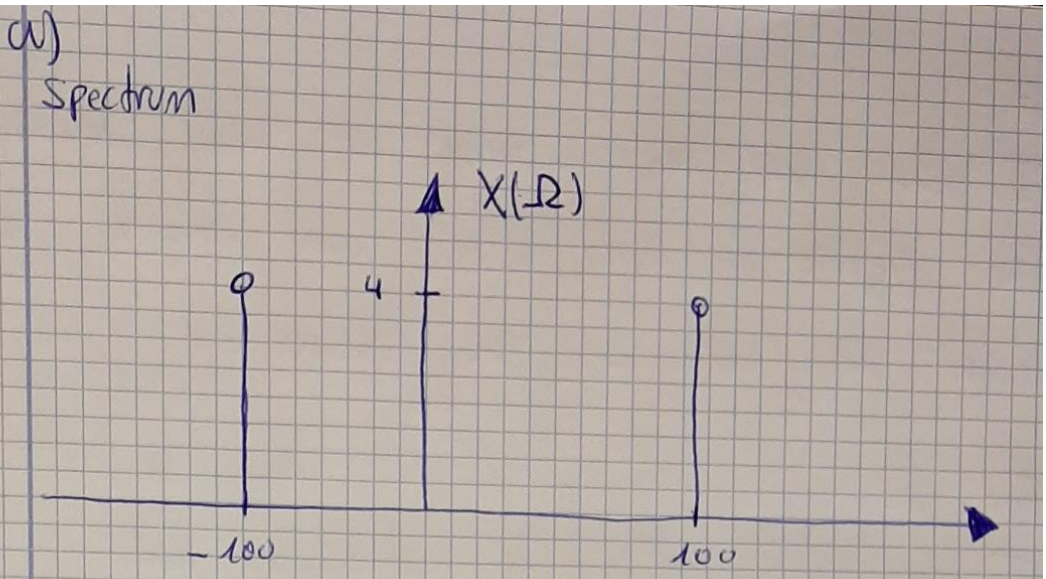
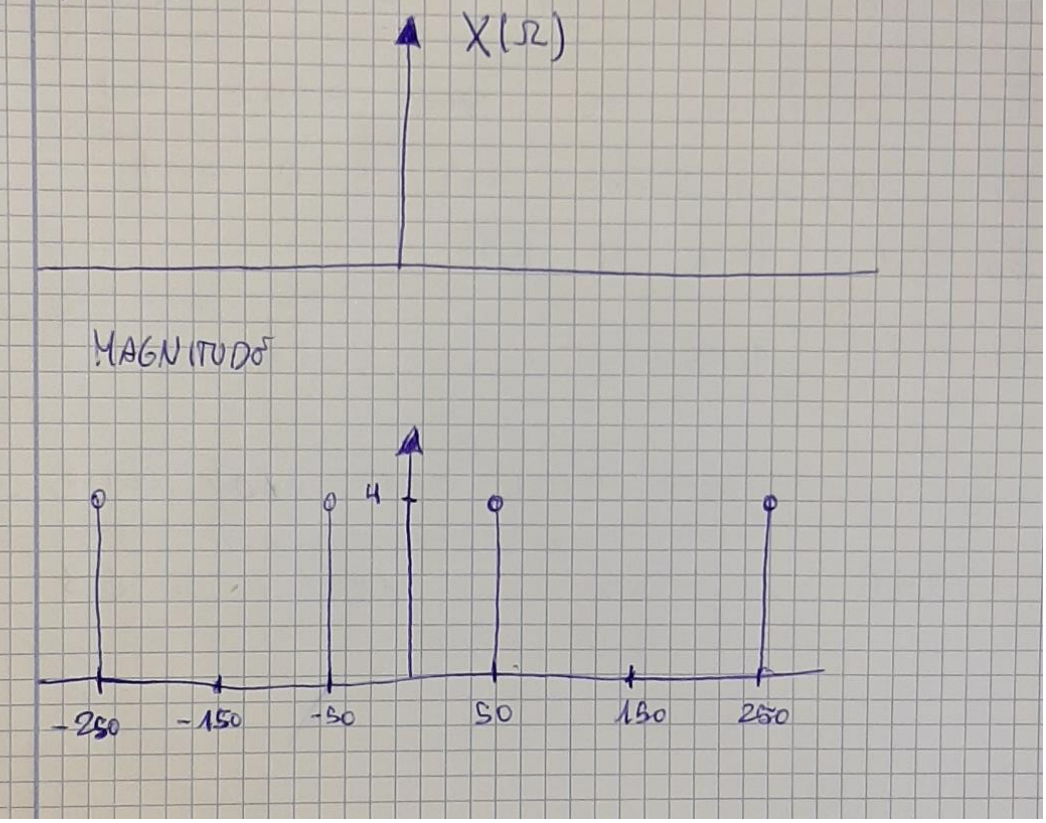
a)

Spectrum




b) PHASE



Code for number 1

```
[a1,b1] = zp2tf([j*2*pi -j*2*pi]',[-1 -0.5+j*2*pi -0.5-j*2*pi],1);
[w,Hm,Ha] = freqresp_s(a1,b1,10);
figure
plot(w,Hm)

[a2,b2] = zp2tf([-1+j*2*pi -1-j*2*pi 1]',[-1 -1+j*2*pi -1-j*2*pi],1);
[w,Hm,Ha] = freqresp_s(a2,b2,10);
figure
plot(w,Hm)


[a3,b3] = zp2tf(1,[-1 -1+j*2*pi -1-j*2*pi],1);
[w,Hm,Ha] = freqresp_s(a3,b3,10);
figure
plot(w,Hm)
```