Homework #11: Chapter 6 (due Wed. Dec. 2, 2015)

Preliminary

- Textbook reading Ch. 6.0 - 6.8 (pp. 423-483)
- As a reminder, EE312 office hours are on Wed. from 9:00-10:00am and Thu. from 3:30-4:30pm.
- Please direct all email to pdeleon@nmsu.edu (do not send email via Canvas).
- In order to receive full credit for homework problems, you must provide a detailed solution. Simply writing a few, summarized steps toward the answer will result in minimal credit.
- All problems are worth +10 points unless otherwise noted.
- There will be no class on Fri. Nov. 20, 2015.
- The final exam is scheduled for 10:30am-12:30pm on Mon. Dec. 7, 2015 in Hardeman Jacobs Learning Center Room 230.

Course Evaluation (+1 Point Bonus on Total Grade)

Please attach to this assignment a receipt showing you completed the EE312 course evaluation available on Canvas. Your constructive feedback is greatly appreciated in order to improve this course. If you are unable to attach a receipt when this homework is due, you made submit a receipt up until Sunday, December 6.

Textbook Problems

6.1	6.5	6.10(a)	6.11(a)	6.15(b)
6.21(a)	6.27(a), (e)–only (i)	6.28(a)* only (ii) and (iv)	6.39(a), (f)*	

*You should use MATLAB to create these plots.

Software Problems

Refer to Homework #8 for information on using MATLAB for frequency analysis of systems and the codes at the end of this assignment which plot magnitude (dB) and phase responses for example systems. Students can modify the codes for other systems and add additional code for labels, gridlines, title, axis, etc. as needed.

1. Recreate Figure 6.5(a) and (b) using the code below.
2. Recreate Figure 6.20 for $\tau = 1$ using the code below. You do not need to include the asymptotic approximation.
3. Recreate Figure 6.28 for $a = 1/2$ using the code below (you need only plot $-\pi \leq \omega \leq \pi$).

Example MATLAB Code

```
%-------------------------------------------------------------------------
% Code for phase responses (wrapped and unwrapped) Figure 6.5
w1 = 315;  z1 = 0.066;
w2 = 943;  z2 = 0.033;
w3 = 1888; z3 = 0.058;

w = [0:10:2500]';
f = w./(2*pi);
H1 = (1 +(j.*w./w1).^2-2.*j.*z1.*(w./w1))./(1+(j.*w./w1).^2+2.*j.*z1.*(w./w1));
H2 = ; % students fill this line in as per p. 432 (6.15)
H3 = ; % students fill this line in as per p. 432 (6.15)
H = H1.*H2.*H3; % product of three factors

figure(1);plot(f,angle(H));
ylabel('Phase (rad)');xlabel('Frequency (Hz)');grid;axis([0 400 -4 4]);

figure(2);plot(f,unwrap(angle(H)));
ylabel('Phase (rad)');xlabel('Frequency (Hz)');grid;axis([0 400 -20 0]);
```

```
%-------------------------------------------------------------------------
% Code for Bode plot of CT system (Figure 6.20)
minFreq = -4;  % 10^minFreq rads/s
maxFreq = 6;  % 10^maxFreq rads/s
omega = logspace(minFreq, maxFreq, 100); % log spread freqs from 10^minFreq to 10^maxFreq
H = 1./(1+j.*omega);   % compute freq resp for p. 448 (6.22) with \tau=1

figure(1);semilogx(omega,20*log10(abs(H)));   % plot mag resp in dB
ylabel('20log_{10}|H(j\omega)|');xlabel('\omega (rads/s)');grid;axis([10^-2 10^2 -60 20]);

figure(2);semilogx(omega,angle(H));   % plot phase resp
ylabel('\angle H(j\omega)');xlabel('\omega (rads/s)');grid;axis([10^-2 10^2 -3*pi/4 pi/4]);
```

```
%-------------------------------------------------------------------------
% Code for frequency response plot of DT system (Figure 6.28)
omega = [-pi:pi/50:pi];    % spread 100 freqs from -pi to +pi
H = 1+0.5*exp(-j.*omega);   % compute freq resp for p. 461 (6.52) with a = 1/2

figure(1);plot(omega,20*log10(abs(H)));   % plot mag resp in dB
ylabel('20log_{10}|H(e^{j\omega})|');xlabel('\omega (rads/sample)');grid;axis([-pi pi -8 20]);

figure(2);plot(omega,angle(H));   % plot phase resp
ylabel('\angle H(e^{j\omega})');xlabel('\omega (rads/sample)');grid;axis([-pi pi -pi/2 pi/2]);
```