E E 1 7 1 (November 28, 2011)

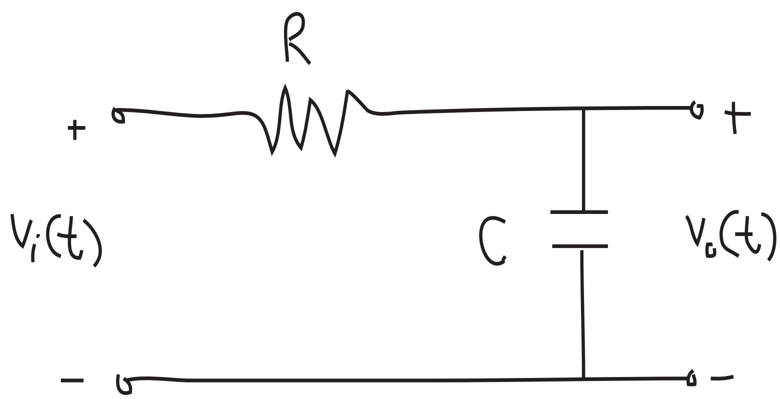
Signals & Systems *Fall Semester 2011*

H O M E W O R K No. 11
Due: Tue. December 6, 2011

1. Problem 9.3, Determining Laplace Transform.
2. Problem 9.4, Calculating Laplace Transform and determining poles and zeros.
3. Problem 9.5, Determining poles and zeros of Laplace Transforms.
4. Problem 9.9, Determining inverse Laplace Transform.
5. Problem 9.10, Determining frequency response from Laplace transform Transfer function (Use Matlab).
6. Problem 9.18, Solving RLC circuit using Laplace Transforms.
7. Problem 9.19, Finding Laplace Transforms.

DESIGN PROBLEM

1. The design problem is to design a RC low-pass filter with a 3db frequency of 1000 hz and a DC gain of 1. Assume that you can use a gain multiplier K. Find R,C and K. You can use Matlabs analog filter function *freqs* for the design.



a. Determine the transfer function,

$$H(s) = \frac{V_o(s)}{V_i(s)}$$

and plot the frequency response using different values of R,C. so that you get the appropriate 3db frequency.

Use Matlab to plot the amplitude and phase of the transfer function.

Example:

For the transfer function

$$H(s) = \frac{0.2s^2 + 0.3s + 1}{s^2 + 0.4s + 1}$$

```
a = [1 0.4 1];
b = [0.2 0.3 1];
w = logspace(-1,1);
freqs(b,a,w)
```

You can also create the same plot using:

```
h = freqs(b,a,w);
mag = abs(h);
phase = angle(h);
subplot(2,1,1), loglog(w,mag)
subplot(2,1,2), semilogx(w,phase)
```

To plot the frequency response at specific frequencies, you can select the frequencies such as:
f=0:0.1:1000 and then:

```
freqs(b,a,f)
```

To convert to hertz, degrees, and decibels, you can use:

```
f = w/(2*pi);
mag = 20*log10(mag);
phase = phase*180/pi;
```