Department of Electrical and Computer Engineering
The University of Alabama in Huntsville

CPE 381: Fundamentals of Signals and Systems for Computer Engineers

Homework #2

Due: Wednesday, February 11 at 2:15 pm
Please bring hardcopy to the class and upload softcopy to Angel

Student name:

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1 10	2 20	3 10	4 15	5 20	6 10	7 15	Total

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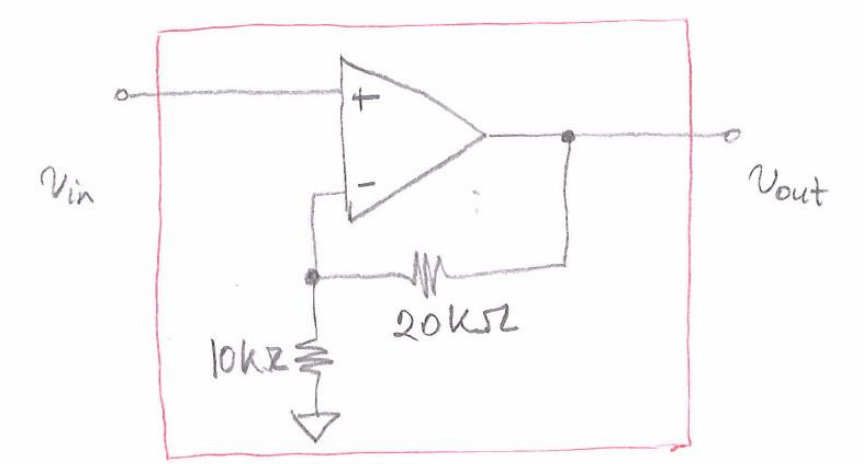
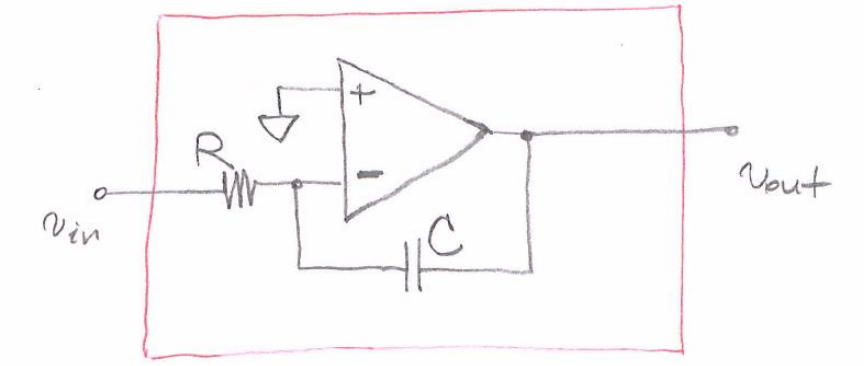
1. (10 points) What is the transfer function of the following circuits





2. (20 points) Pr. 1.20

1.20. Multipath effects, first part—MATLAB

In wireless communications, the effects of *multipath* significantly affect the quality of the received signal. Due to the presence of buildings, cars, etc. between the transmitter and the receiver, the sent signal does not typically go from the transmitter to the receiver in a straight path (called *line of sight*). Several copies of the signal, shifted in time and frequency as well as attenuated, are received—that is, the transmission is done over multiple paths each attenuating and shifting the sent signal. The sum of these versions of the signal appears quite different from the original signal given that constructive as well as destructive effects may occur. In this problem we consider the time-shift of an actual signal to illustrate the effects of attenuation and time shift. In the next problem we consider the effects of time and frequency shifting and attenuation.

Assume that the MATLAB "handel.mat" signal is an analog signal $x(t)$ that it is transmitted over three paths, so that the received signal is

$$y(t) = x(t) + 0.8x(t - \tau) + 0.5x(t - 2\tau)$$

and let $\tau = 0.5$ seconds. Determine the number of samples corresponding to a delay of τ seconds by using the sampling rate F_s (samples per second) given when the file "handel.mat" is loaded.

To simplify matters, just work with a signal of duration 1 second—that is, generate a signal from "handel.mat" with the appropriate number of samples. Plot the segment of the original "handel.mat" signal $x(t)$ and the signal $y(t)$ to see the effect of multipath. Use the MATLAB function sound to listen to the original and the received signals.

3. (10 points)

Find impulse response of capacitor and its unit step response.

4. (15 points)

Find transfer function of the circuit in problem 1.b.

5. (20 points)

Use Matlab symbolic computation to find the Laplace transform of a real exponential $x(t) = 5e^{-2t}\cos(8t)u(t)$

Plot the signal and the poles and zeros of their Laplace transform.

Repeat the analysis and plot the results for $x(t) = 5e^{-4t}\cos(8t)u(t)$

Discuss the changes in the *s* plane and describe their effect on function in time domain.

6. (10 points)

Describe the basic properties of the one sided Laplace transform.

7. (15 points)

Find Laplace transform of the full wave rectified signal.