**ECE 580 Final Project**

**Due Dec. 4, 2015 , in class**

*A. Find the output/input transfer function H(s) = Vout/Vin of a continuous-time low-pass filter with the following specifications:  
  
Passband: DC to fp = 20 kHz, gain between 0 dB & 1 dB.  
  
Stopband: f > fs = 40 kHz, gain below -50 dB.*  
a. Calculate the coefficients, zeros and poles of *H(s).*  
  
b. Show the zeros and poles in the s-plane.  
  
c. Factor the numerator and denominator into their lowest-order real  
    factors.  
  
d. Plot the gain and phase for 0 < f < 150 kHz.

*B. Find a realization for the transfer function H(s).*a. Find the circuit diagram and element values.  
  
b. Scale the element values so that the maximum output voltages of all  
    active blocks are equal.

c. Simulate your circuit before and after scaling, assuming ideal  
    elements.

d. Repeat c. including nonideal effects such as finite opamp gain,  
    finite nonzero input and output impedances, parasitic capacitances,  
    etc. Comment on how these effects can be minimized.