ENGR 12 Assignment 14 Due: next wed

**Part I. Drills -- 1 point each**1) A series RC lowpass filter requires a cutoff frequency of 8 kHz. Use R = 10 kΩ and compute the value of C required.

|  |  |
| --- | --- |
|  |  |

2) A series RL highpass filter with a cutoff frequency of 2 kHz is needed. Using R = 5 kΩ, compute   
 a) L, b) |H(w)| at 200 Hz, c) Phase(H(w)) at 200 Hz

|  |  |
| --- | --- |
|  |  |

3) A series RLC has a 0.1 uF capacitor. Find R and L for a bandpass filter with a center frequency of 12 kHz and a Q of 6

|  |  |
| --- | --- |
| http://webpages.ursinus.edu/lriley/ref/circuits/img58.gif |  |

4)

**Part II. Assisted Problem Solving – 2 pts**

|  |  |
| --- | --- |
| 6) Find the transfer function Vout/Vin and the corner frequency w. What kind of filter is it? Plot the magnitude and phase of H(w) using Freemat or WolframAlpha.  diagram | Plan   1. It tends to be easier to derive transfer functions when the component values are defined as symbols: use R1, L and R2 for the three values. 2. Use the voltage divider formula to derive H(w) 3. Then find H(w) by taking Vout/Vin 4. Substitute in the numeric component values, and 5. Plot the magnitude and phase of H(w) using Freemat. |
| 7) Find the transfer function Vo/Vs for the following circuit. Show that it is a low pass filter.   14-083 | PLAN   1. Use L, R, and C as the component values while you derive H(w) 2. Simplify the formula into a simple fraction form. (remove fractions in the numerator and denominator) 3. Determine H(0) and H(infinity) and use this to argue that kind of filter it is |

**Part III. Unassisted Problem Solving – 3 points**

8) Find the transfer function for this circuit given R1=R2=110 k, C1 = 4uF, C2 = 2 uF. Determine the cutoff frequency and plot the magnitude in Freemat. Hint: Use Nodal Analysis at the R1/R2/C1 node and Node 3. Negative feedback means V2 = V3.

