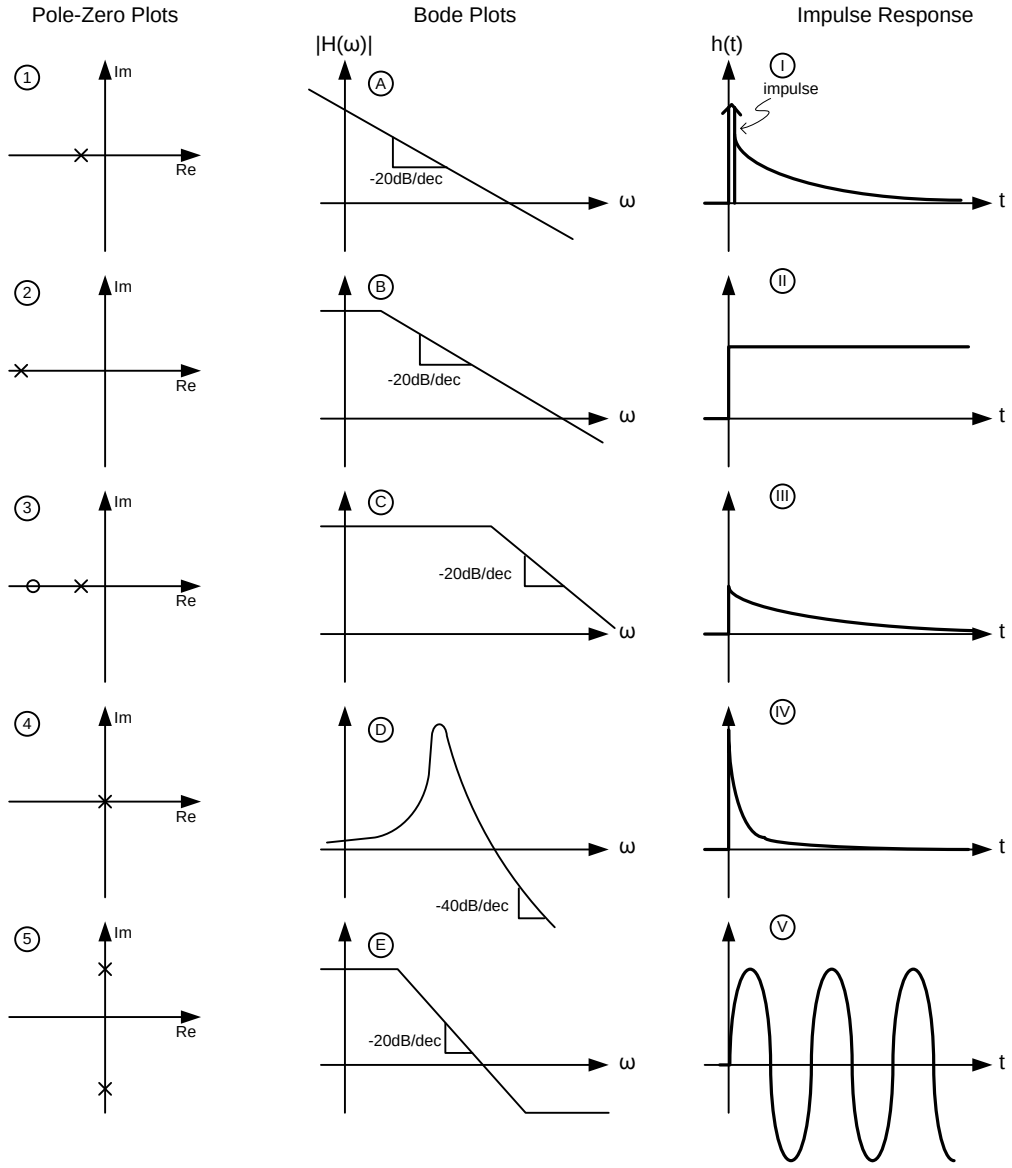
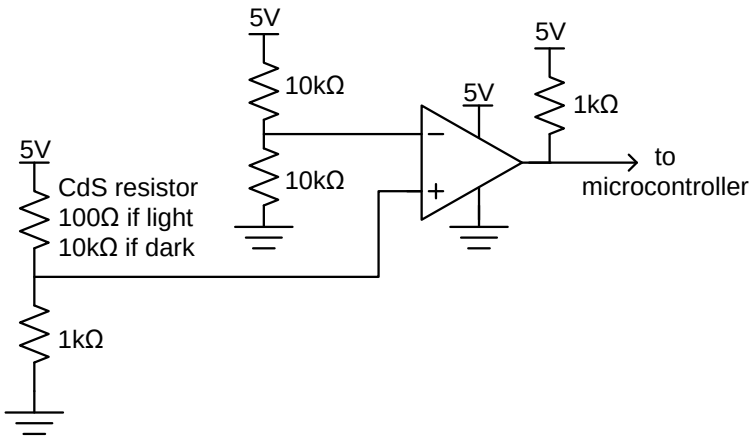
Problem 1

Match each pole-zero plot with a Bode plot, and a time-domain plot of h(t). Hint: try recreating H(s) given the pole-zero plot.



Problem 2
You are designing a sensor system for an automatically-closing microprocessor-controlled miniblind system. The light sensor outputs a digital signal to a microprocessor. You design the following circuit:



It works well when exposed to sunlight and in an office lit by incandescent light, but works unreliabily in an office lit by fluorescent lights.
a) Why?

b) What kind of filter (LP, BP, BS, HP) would prevent this?

c) Where would you put the filter? What order would you use?

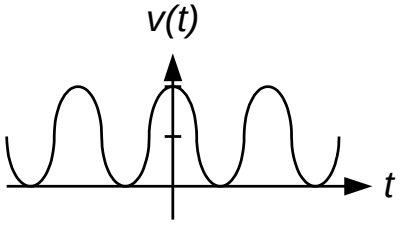
d) What would you design its cutoff frequency to be?

e) Why would 10kHz be a poor choice for filter cutoff frequency?

f) Why would 100μHz be a poor choice for filter cutoff frequency?

Problem 3

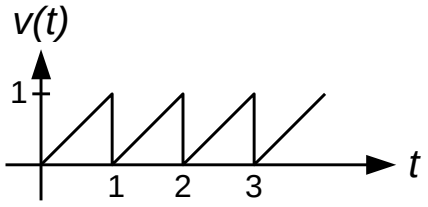
b) Find numeric values for the Fourier Series coefficients a_0, a_1, a_2, b_1, and b_2 for $v(t) = 1 + \cos(2t)$ as shown:



b) If the waveform was very slightly shifted to the right, which components would increase, decrease, or stay the same?

Problem 4

Find c_{-2}, c_{-1}, c_0, c_1, and c_2 in complex polar form for the complex Fourier Series coefficients of the waveform.



Problem 5

The waveform from Problem 4 is applied to this circuit: Find the DC and first two harmonics of $v_o(t)$