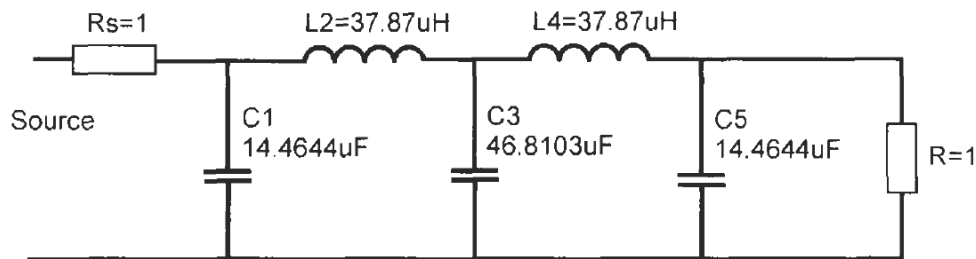
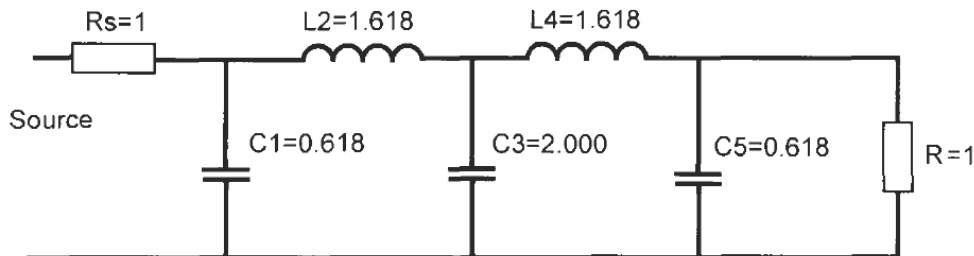


# ESD – Review Problem Set #1

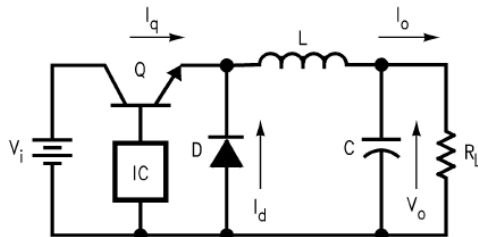
- Design a highpass filter that is flat in both passband and stopband with cutoff frequency of 3 kHz and 60dB attenuation at 1 kHz and assuming a source and load resistances of  $50\Omega$  each. Provide two versions of the filter in (a) Shunt C and (b) Series L.
- Design a 5<sup>th</sup> order Bessel lowpass filter that has cutoff frequency of 300 Hz and 40dB attenuation at 1 kHz with a load resistance of  $1k\Omega$ . Provide two versions of the filter in (a) Shunt C and (b) Series L.
- Convert the following lowpass filter with cutoff frequency of 6.8 kHz into a bandpass filter with center frequency of 20 kHz. Assume source/load resistance of  $50\Omega$ .



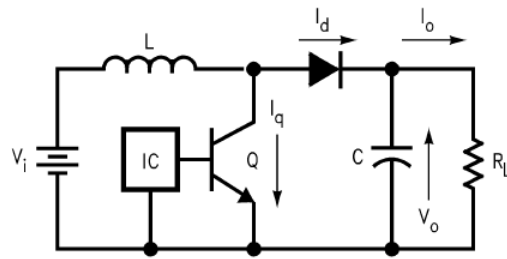
- Convert the following normalized lowpass filter with into a bandstop filter with center frequency of 50 Hz and band of rejection from 45-55 Hz (3dB) assuming source/load resistance of  $50\Omega$ .



- In the Buck regulator shown, assuming the capacitor voltage at  $t=0$  is 0 V and that the IC will keep the transistor switch Q ON, draw the waveform for both the capacitor voltage  $V_o$  and the switch current  $I_q$ .



6. For the shown switching regulator, given that  $V_i = 5V$  that  $T = 10 \mu s$  and switch Q on time or  $t_{(on)} = 2 \mu s$ . Draw the waveforms for  $V_o$  and  $I_q$  for one complete cycle.



7. Design a 5V to -15V switching power supply.
8. Design a circuit that allows a 5V output from a microcontroller to ON/OFF control a 220V AC supply to a lamp.
9. Design a circuit that allows a microcontroller to select one of 6 different analog signals to be connected to the input of an ADC.
10. Design a circuit that allows a user to deliver a signal to one of 4 different channels or completely block all signals.
11. Design a monostable multivibrator circuit that has a pulse width of 100 ms and a normally on load. Draw the output waveform of the circuit for a single input pulse with width of 250 ms.
12. Design an astable multivibrator circuit that has a period of 1 ms, a duty cycle of 1/3 and a normally off load.
13. Design a circuit that performs a weighted sum of 3 signals with relative weights of 1:1.5:2 respectively.
14. Design a circuit that allows balanced outputs (i.e.,  $E_o^+$  and  $E_o^-$ ) of twice the input voltage  $E_i$ .