Lab 4: Passive Filters

1. Design and construct a *high-pass filter*, an *RC* circuit that can filter out 60 Hz but yet still pass signals in the kHz region. Connect a 10 kHz output from your signal generator to one terminal of the 6.3V transformer on your breadboard. This will add a large 60 Hz component onto the signal when emerges at the other transformer terminal. Your filter should be able to clean it up. Measure the ratio of signal to noise (S/N), and compare it to your calculations, where "signal "is the peak-to-peak amplitude of the 10 kHz sine wave, and "noise" is the peak-to-peak amplitude of the 60 Hz component.
2. Design and construct a *band-pass filter* which will only pass frequencies near 10 kHz. Do this by combining 2 different *RC* filters. Measure its response (amplitude ratio and phase difference) when driving a load of 100 kΩ at 50 Hz, 100 Hz, 1 kHz, 5 kHz, 10 kHz, 20 kHz, and 50 kHz.
3. Design and construct a notch filter which will attenuate roughly 1 kHz by at least 60 dB, but will pass signals with frequencies 20% higher and 20% lower with less than 6 dB of attenuation, and can drive a 100 kΩ load. Assume that the signal source has a 50 Ω Thevenin impedance (i.e. function generator). Construct the circuit and characterize its performance of (i.e. measure the amplitude ratio and phase difference) when driving a 100 kΩ load.