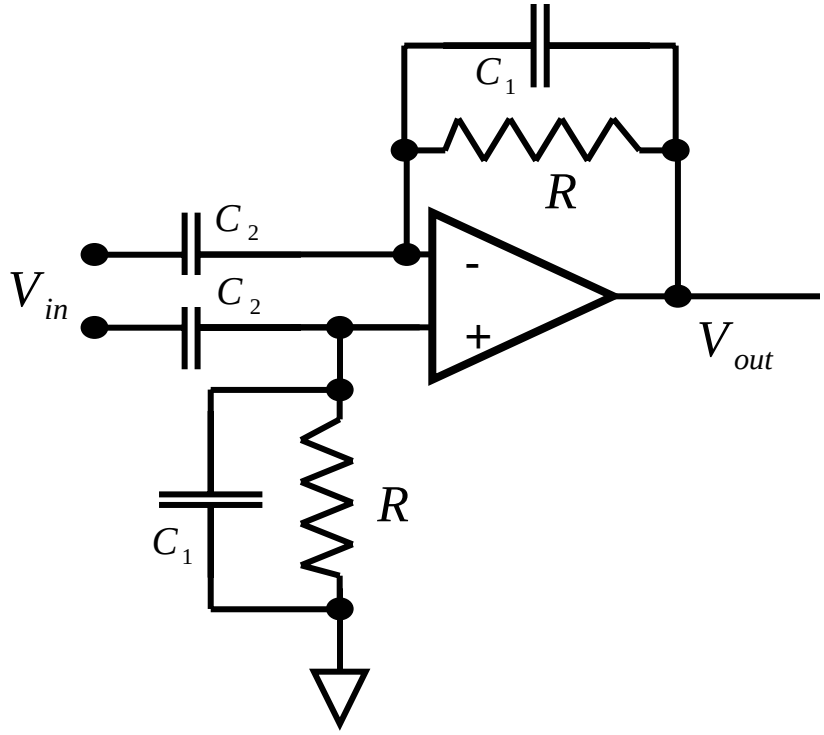
ECE 491: Biomedical Instrumentation (Homework1)

Due Friday (10/15/2007)

1) In this problem you will design a biopotential amplifier for amplifying neural signals whose amplitude range from $10\mu V - 10mV$ and whose frequency lies between $0.1Hz - 10{,}000Hz$. Calculate values of C1, C2 and R for a bandpass filter shown in below with a passband (3dB) 0.1Hz – 10000 KHz. Assume that the op-amp has a finite gain of 10,000 and the amplifier gain should be at-least 100. [10 points]



2) In this problem you will develop a simple equivalent circuit that can generate a waveform similar to a cardiac signal. A cardiac signal comprises of five major states denoted by P,Q,R,S,T. You can assume that the pacemaker cells in sino-atrial node can be modeled by a square wave generator with frequency of 70 Hz and duty cycle of 5%. For this problem you can use ideal op-amps, resistors and capacitors. Take a look at the diagram titled cardiac signal pathways in the lecture notes. Replicate the PQRST wave-form with similar time-scales by designing a circuit for each cardiac nodes (right atria, left atria, AV node, bundle of His, right and left ventricle). The PQRST waveform is achieved by superposing the signals from all cardiac nodes. Also using this electrical model create conditions for ventricular fibrillation. [10 points]