

ECE 491: Biomedical Instrumentation Homework 2

Due Friday (10/29/2007)

1. A student attempts to measure his own ECG on an oscilloscope having a differential input. For the set up shown in Biopotential amplifier II (slide 2), with $Z_{in} = 1\text{Mohms}$, $Z_1 = 1\text{Mohms}$, $Z_2 = 10\text{Kohms}$, $Z_G = 30\text{Kohms}$ and $i_{db} = 0.5\text{ microamperes}$, calculate the power-line interference the student observes.
2. Design a driven right-leg circuit and show all resistor values. For 1 microamperes of 60 Hz current flowing through the body, the common-mode voltage should be reduced to 2mV. The circuit should apply no more than 5 microamperes when the amplifier is saturated at $\pm 13\text{V}$.
3. Design an ECG instrumentation amplifier with gain 1000, with frequency response between 0.1 Hz – 1000 Hz.
4. Design a biopotential preamplifier that is battery-powered and isolated in such a way that there is less than 0.5pF coupling capacitance between the input and output terminals. The amplifier should have a nominal gain of 10 and an input impedance greater than 10Mohms differentially and greater than 10GOhms with respect to ground. The output impedance should be less than 100 ohms and single ended. Assume all opamps are ideal.