# BME/ECE 386 QUIZ (W20)   NAME:_____

1 problem for 20 pts

ECG Amplifier

You are asked to design an ECG system to monitor a patient in a helicopter (i.e. being flown to a hospital). Suppose the ECG input is a PQRST waveform with a 1 mV amplitude R-wave. The patient's heart rate is 100 beats per minute. This desired signal is superimposed with a constant 25 mV differential offset voltage (e.g. due to skin-electrode impedance mismatch). The helicopter vibration produces a 30 Hz common mode voltage with a peak amplitude of 2.5 V. The instrumentation amplifier has a differential gain A_d = 30, CMRR = 75 dB, and V_{REF} = 0.5V.

a) Compute and sketch the instrumentation amplifier output over a 3 second interval. Label important features.

b) After the instrumentation amplifier we want a circuit that blocks DC. The op amp circuit shown below combines a high pass filter with an inverting amplifier. Use the Golden Rules to show that:

$$\frac{V_{out}}{V_{in}} = -\frac{R_2}{R_1}\frac{jf/f_C}{1+jf/f_C}$$
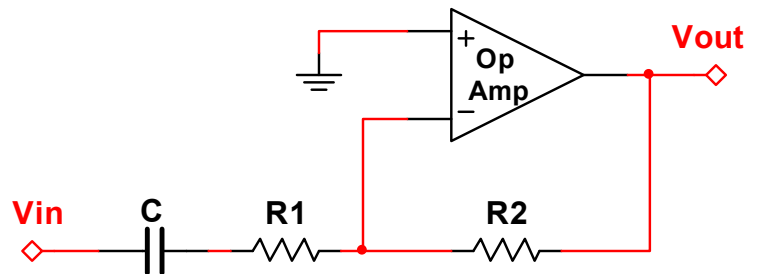
NOTE: SHOW ALL WORK, and make sure to clearly define f$_C$ (i.e. in terms of R$_1$, R$_2$, and/or C)!

(extra sheet for work)