NAME (please print) _____________________________ SID _________________

UNIVERSITY OF CALIFORNIA, BERKELEY
Electrical Engineering and Computer Sciences Department

EECS 145L Electronic Transducer Lab
MIDTERM #2 (100 points maximum)
November 28, 2007

(closed book, calculators OK, equation sheet provided)
(You will not receive full credit if you do not show your work)

PROBLEM 1 (40 points)

In 50 words or less, describe at least two essential differences between the following two items:

1.1 (8 points) [platinum resistance thermometer] and [thermistor]

1.2 (8 points) [incandescent lamp] and [fluorescent lamp]

1.3 (8 points) [PIN photodiode] and [LED (light-emitting diode)]

1.4 (8 points) [Peltier heat pump] and [thermocouple]

1.5 (8 points) [electromyogram (EMG)] and [electrocardiogram (ECG)]

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PROBLEM 2 (24 points)

2.1 (12 points) What are the technical requirements of the ground fault interrupter circuit?

2.2 (12 points) Describe how the ground fault interrupter circuit functions to meet those requirements.

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PROBLEM 3 (36 points)

You have an ultrasound ranging (distance measuring) system that emits a train of ultrasound pulses with frequency f and detects the echos. The system produces square-wave pulses that go from 0 to 5 V when each pulse is emitted and return to 0 V when an echo is received.

3.1 (10 points) Design and sketch a circuit that converts the square wave pulses into a voltage that is proportional to distance.

3.2 (6 points) Assuming that the speed of sound in air is 30 m/s, derive an equation that relates the voltage in part **3.1** to the distance in meters.

3.3 (6 points) If the ultrasound pulse rate f = 10 Hz, what is the greatest distance you can accurately measure?

3.4 (14 points) Design and sketch a control system for keeping a highway vehicle separated from the vehicle ahead by one half of your answer to part **3.3**. Assume that engine power (acceleration) is proportional to a positive control signal and braking (deceleration) is proportional to a negative control signal.