Name

Real Time Systems

EE 4770

Makeup Midterm Examination*

5 April 1993, 15:00–16:50

Problem 1	_____	(33 pts)
Problem 2	_____	(34 pts)
Problem 3	_____	(33 pts)
Exam Total	_____	(100 pts)

Alias _____

Good Luck!

The wording of the questions on this exam may have been modified so that they are consistant with terminology used this semester.

Problem 1: Design a circuit to measure temperature using a resistance thermal device (RTD), a wheatstone bridge, and an appropriate amplifier. The circuit is to measure temperature in the range of 210 to 250 Kelvins with an output voltage of $v_o = \frac{(T-210)}{4\,\mathrm{K}}\,\mathrm{V}$. The RTD has $\alpha = 0.004$ and $R_0 = 12.3\,\mathrm{k}\Omega$. Draw the circuit, and give values for all components and voltage sources. (33pts)

Problem 2: Design a circuit to measure light in a room using sensors in two different locations. The circuit is to have two outputs, one output, v_o, gives the *average* irradiance of light on the two sensors. The other output is logic "1" when the irradiance on one sensor is $7\,\frac{\mathrm{mW}}{\mathrm{cm}^2}$ more than the other and logic "0" otherwise. Use a photodiode with $k = 2.7\,\frac{\mu\mathrm{A}\,\mathrm{cm}^2}{\mathrm{mW}}$. Let the average irradiance on the two sensors be H_a; then $v_o = \frac{H_a}{3}\,\frac{\mathrm{cm}^2}{\mathrm{mW}}\mathrm{V}$.

Problem 3: Briefly answer each of the following.

(a) Find the threshold voltage(s) for the level detector shown below.

Choose random resistor values for the hystersis threshold detector presented in class.

(b) Draw two diagrams showing how an LDTV (linear differential variable transformer) is used to measure displacement. One diagram should show the sensor along with an object being measured. The other diagram should be a schematic of the LDTV. Explain how the object's displacement effects the LDTV's electrical properties.

(c) Briefly explain the different between calibration error, repeatability error, and stability error.