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Real Time Systems
EE 4770
Makeup Midterm Examination*
19 April 1993, 15:30–16:20

Problem 1 _____ (33 pts)

Problem 2 _____ (34 pts)

Problem 3 _____ (33 pts)

Alias _____

Exam Total _____ (100 pts)

Good Luck!

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

Problem 1: Design a circuit to convert irradiance in the range of 0 to $20 \frac{\text{mW}}{\text{cm}^2}$ to a voltage $v_o = \frac{H}{2} \frac{\text{cm}^2}{\text{mW}} \text{V}$. Use a photodiode with sensitivity $k = 2.7 \frac{\mu\text{Acm}^2}{\text{mW}}$. The circuit should have a low output impedance.

Problem 2: A sensor system is to monitor the water level in two tanks, tank A and tank B . Of interest is the total amount of water in the two tanks and the percentage of water in tank A . The system is to have two outputs, one gives the total amount of water in the two tanks, $v_{\text{total}} = \frac{l_A + l_B}{m} V$, where l_A and l_B are the water level in the two tanks, respectively. The other output gives the percentage in tank A , $v_{\%A} = 10 \frac{l_A}{l_A + l_B} V$.

(a) Show how the level detectors could be built. (5pts)

(b) Show the circuit to produce v_{total} . (15pts)

(c) Show the circuit to produce $v_{\%A}$. (14pts)

Problem 3: Briefly answer each of the following.

(a) Show how a three-wire RTD is connected in a bridge. Explain how the problem of wire resistance is eliminated. (11pts)

(b) Draw a diagram of a photomultiplier tube. Explain how current leaving the cathode is multiplied. (11pts)

(c) Explain the difference between photometric and radiometric measures of light. Would it be easier to build an ideal (with respect to spectra) photometric or radiometric detector? (11pts)