

Space Hardware Experiment Design

ASEN4519 / 5519

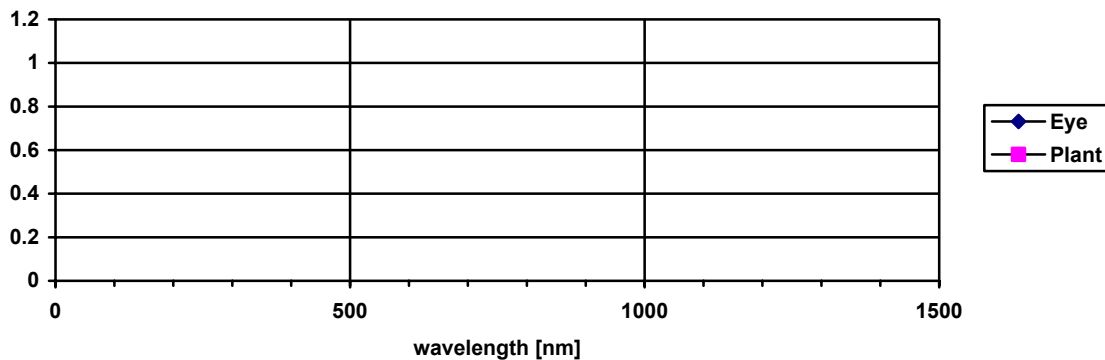
Homework #3

Name: _____ Due Date: 20/25 Nov. '03
 Unique Identifier _____

Note: You may have to make assumptions (and properly state those) to solve the problems (that's life). Not all required information may be given. If in doubt, simplify with real life assumptions. This test is meant to be easy. Don't hesitate to ask questions (303) 492-5875 or email (hoehn@spot.colorado.edu) if you get stuck.

Question 1 - Light:

Show the sensitivity of the human eye as a function of wavelength. Show the difference to light used by plants for energy conversion. Indicate the ultraviolet and Infrared region. Which wavelength corresponds to blue, yellow, green, red light? The peak intensity of sunlight on Earth is approximately at what wavelength?



Question 2 - Data Acquisition:

Given: 12 bit analog to digital converter (A/D), 16 single-ended or 8 differential channels, input range can be set by user to +5V (unipolar), $\pm 5V$ (bipolar), +10V (unipolar) or $\pm 10V$ (bipolar).

You are using an IC temperature sensor LM335 with a signal of $10 \text{ mV}/^\circ\text{C}$ and an output offset of 2.73V at 0°C (i.e., $273\text{K} = 2.73\text{V}$). The sensor will be used between 0°C and 100°C .

1. What is the best input voltage setting for your A/D converter (+5V, $\pm 5V$, +10V, $\pm 10V$) using this sensor between 0 and 100°C and why ?
 Output at 0°C: _____ Volt
 Output at 100°C: _____ Volt
 Voltage range needed: _____ for best resolution
2. at the setting of +5V (unipolar), what is the best resolution (both in mV and °C) that you can measure using the 12 bit A/D converter (resolution = capability to distinguish two voltages / temperatures from each other).

(fill in table below)

3. What would the best resolution (°C and mV; see 2. above) be, if you had a) a 16 bit A/D, and b) if you had a 8 bit A/D converter, using the same LM335 sensor described in 1.

(fill in table below)

4. You are considering using a different sensor, the LM34 (offset: 0°F = 0V, slope: 10 mV/°F). What is the best resolution (in °C) using the LM34 sensor with the 12 bit A/D converter at +5 V input range setting (unipolar). Given a choice, which sensor would you use for your experiment (to be measured: 0°C -> 100°C, as accurate as possible)? Why ?

Output at 0°C: _____ Volt
 Output at 100°C: _____ Volt
 Voltage range needed: _____
 Resolution of LM34 _____ °C / 'step'

A/D set at +5V unipolar	8 bit	12 bit	16 bit
Integer range ('steps')			
mV resolution at 0-5V range			
°C resolution using LM335 (10mV/°C)			
°C resolution using LM34 (10mV/°F)			

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