Photodetectors

1. Calculate the photocurrent density from red light in a silicon p-i-n photodiode, with an intrinsic region width of 20 μm. Assume that the photon flux is $10^{17} \text{ cm}^{-2}\text{s}^{-1}$, and the absorption coefficient $\alpha = 10^3 \text{ cm}^{-1}$. Account for the non-uniform generation rate across the intrinsic region, and the surface reflection (in air) due to the index of refraction $n = 3.4$. What is the total current for a junction area $A = 10^{-4} \text{ cm}^2$?

2. Calculate the -3dB frequency for the above p-i-n photodiode, assuming an electron velocity of $10^6 \text{ cm/s}$. Based on an electron mobility of $1200 \text{ cm}^2/\text{V-s}$, what is the electric field, and the reverse bias voltage needed to produce this velocity?

3. Estimate the solar insolation AirMass number from the length of the shadow of a vertical rod, $h = 1$ meter high. The shadow length $s = 1.118$ meter long.

Homework assignments will appear on the web at:
http://www.ece.udel.edu/~kolodzey/courses/eleg867f09.html.

Note: On each homework and report submission, please give your name, the due date, assignment number and the course number.