EECE 598, Homework 05

Try to solve the problems by yourselves. Compare with your solutions after you are done. Exams will be similar formats as these.

1. **Problem 6-1.**
2. **Problem 6-3.**
3. **Problem 6-6.**

No submission is required. The solutions to select problems will be uploaded a week later.

6.1 Consider the absorption coefficient of silicon as a function of wavelength, as shown in Fig. 6.18. Ignoring reflections at the photodiode surface, plot the following two parameters over the wavelength range 600–1000 nm:
(*a*) The quantum efficiency for depletion layer widths of 1, 5, 10, 20, and 50 μm.
(*b*) The responsivity for a silicon *pin* photodiode having a 20-μm thick depletion layer.

6.3 If the absorption coefficient of silicon is 0.05 μm^{-1} at 860 nm, find the penetration depth at which $P(x)/P_{in} = 1/e = 0.368$.

6.6 An InGaAs *pin* photodiode has the following parameters at 1550 nm: I_D = 1.0 nA, $\eta = 0.95$, R_L = 500 Ω, and the surface leakage current is negligible. The incident optical power is 500 nW (–33 dBm) and the receiver bandwidth is 150 MHz. Compare the noise currents given by Eqs. (6.14), (6.15), and (6.16).