Physics 47 — Optics
Problem Set 6
Due Fri, Oct 27, 2017
(before start of class)

Textbook Problems

1. Hecht 9.3 [8 pts.]

2. Hecht 9.23 [3 pts.]

3. Hecht 9.24 [4 pts.]

4. Hecht 9.50 [4 pts.]

5. Hecht 9.57 [4 pts.]

Additional Problems

A1. **Fabry-Perot Spectroscopy of Hydrogen Isotopes** [5 pts.]
The emission spectra of different isotopes of the same element (e.g. hydrogen and deuterium) are *slightly* shifted by the change in the mass of the nucleus. For the red $H\alpha$ (hydrogen-alpha) line of the Balmer series, the wavelength is 656.28 nm for hydrogen, and 656.10 nm for deuterium. ($\Delta\lambda = 0.18$ nm). You wish to create a special Fabry-Perot interferometer for measuring this splitting.

   a) What mirror spacing is needed to create a Fabry-Perot interferometer with a free spectral range of 0.5 nm?

   b) Assuming the mirror spacing from a), what is the order number N (number of half-wavelengths fitting in the cavity) for each of the two wavelengths? (Round down to the nearest integer value.)

   c) The reflectance of the mirrors you have available is $R = 0.9$. What is the Finesse?

   d) What is the half-width γ of the cavity resonance? Give the answer in both frequency units and in wavelength units.