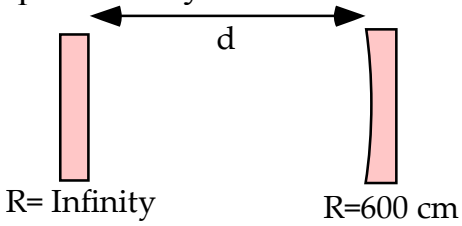
Prelim 1
ECE 4300
October 8, 2014

Problem 1. Consider the optical cavity below




a. What is the largest spacing *d* that still allows the cavity to be stable?

b. Set *d* equal to 1/3 the maximum value of *d* found in part (a). Determine $q_0$ on the flat mirror if $\lambda$ is equal to 600 nm. (Safety net: if you get a bad answer for part (a), you may not be able to get an answer here. If all else fails, choose a length d=20 cm and proceed with the rest of the questions.)

c. How large is the beamwaist, $\omega_0$, in the cavity? Where is it located?

d. What is the difference in frequency between the $TEM_{20q}$ and the $TEM_{00q}$ mode? Sketch the mode amplitude, E(x) of the $TEM_{20}$ mode.

e. What is the full diffraction angle of the beam that exits the laser cavity in the far field?

Problem 2. Etalon used as a filter
An optical communication link has 2 channels made using two laser beams, one operating at 1500 nm and the second operating at 1500.3 nm.

a. What is the difference in frequency between the two laser beams?
b. You need to create a filter that blocks the transmission of one of the beams, but allows the other beam to transmit completely. You decide to use an etalon to achieve this filtering. What is the optimal FSR of the etalon for this application?
c. Assume you need to transmit 100% of the desired beam, and less than 1/1000 of the other beam. What is the minimum reflectivity you could specify for an etalon used in this application?