ECE170A Project 1

Start date: **10/22/19**

Due Date: **10/31/19**

Use the Matlab LiveScript tool for writing and turning in your code. Codes should be in .mlx format. See this youtube video for a tutorial on LiveScript

> **https://www.mathworks.com/videos/introducing-the-matlab-live-editor-119100.html**

1. **Sellmeier equation for refractive index**: Given Sellmeier coefficients of diamond and SiO2 in lecture slide (or in the book), plot the refractive index vs. wavelength, n(λ) from 0.4 μm to 2 μm for both material, using MATLAB. Plot both in the same figure.

2. **Fabry-Perot cavity:** Consider two optical cavities, one with diamond and the other with SiO2, inside. Mirror separation is 500 μm and the mirror reflectivity are R=95%. Use the refractive indices calculated in problem 1,
    (a) plot the intensity spectrum of Fabry-Perot cavity from 1500 nm to 1530 nm
    (b) Repeat for R=80%. Explain what changed and why.

    For the mode nearest to 1510 nm, calculate:

    (c) the mode wavelength

    (d) the cavity Finesse

    (e) the Free-spectral range

    (f) and spectral width

3. Diffraction   pattern:
    (a) Plot the intensity diffraction patterns, $I(\theta)$ for a single slit with widths of 20μm, 40μm, 80μm and 160μm. Assume a light wavelength of 532nm (green light).

(b)   Repeat   for   blue   light   (402nm)   and   red   light   (670nm).
(c) Plot the intensity diffraction pattern for a 4 slit grating with a=d = 10μm. (See figure below)

One possible
diffracted beam

y

Incident
light wave a

d

θ

z

$d\sin\theta$