Summary I

The really big picture:

- Mathematical methods
  - → Complex algebra
  - → Fourier transforms
- Physical insights
  - → Properties of harmonic oscillators, including the effects of driving, damping, and coupling.
  - → Properties of electromagnetic waves, including refractive response, effects of refractive boundaries, polarization, diffraction, and propagation.
  - → Properties of optical systems: simple imaging, and not-so-simple imaging (thick lenses, matrix methods, aberrations, and diffraction gratings)

Summary II

Tidbits you should know about (*i.e.*, be prepared to discuss on an exam):

- The damped, driven harmonic oscillator: remember how it works, and what its properties are. Energy transfer and phase shifts near resonance.
- Coupled harmonic ocscillators and modes.
- The damped, driven harmonic oscillator model. Going from polarization of electrons in atoms to the dielectric constant to the refractive index. The dominant oscillator frequency in nature and why most materials become opaque at wavelengths shorter than around 200 nm.
- The concept of optical path length (nz). How this explains how light travels in a straight line (it travels any which way, but only those paths near a straight line reinforce).
- Understand how to come up with the thin lens equation from the result for single refractive interfaces.
- Understand how to use matrix methods, and nodal points and principal planes in thick lenses.

Summary III

More tidbits:

- Understand how to calculate spatial aberrations.
- Understand how achromats work.
- Understand how telescopes work.
- Understand how human vision works.
- Remind yourself of the Fresnel equations: how they come about, and what the various expressions tell you.
- In Fourier transforms, understand the relationship between time and frequency, and space and spatial frequency. Remind yourself of the characteristics of Fourier transforms of a delta function, a gaussian, and a tophat or rect fuction.
- Understand how wavefield propagation is calculated, and what the Fresnel and Fraunhofer approximations involve and when they are each applicable.
- Understand how propagation can be used to describe simple lens imaging.

Summary IV

More tidbits:

- Understand diffraction from single and double slits, and then from N slits.
- Understand how diffraction sets a resolution limit for lens imaging systems (Rayleigh resolution), and for monochromators and spectrometers.
- Understand the basics of how lasers work.
- Understand the basics of how fiber optics work.

Tidbits covered only in the lab, but which could appear on the exam:

- How an Michelson interferometer works
- How a Fabry-Perot interferometer works

Between now and the final

Help!

- I will be in my office often but the best bet is to send me e-mail to make an appointment. I am happy to meet you to discuss any questions you might have!
- Remember that we have an optional session to go over the final homework assignment (to be posted on web today. . .) on Tuesday, May 9, at 10 am til noon in room D-122.

The exam (8:00-10:30 am on Monday, May 15, in P-112):

- The exam will be roughly a third on new stuff since exam 2, and roughly a third on old stuff from exams 1 and 2.
- As before, you will be given an equation sheet. You'll have a chance to look at it on the web, and you get it handed out with the exam.
- It's up to you to know what the expressions on the equation sheet mean and how they can be applied!
- You will probably get one or two problems which will *not* involve numerical calculations. For example, you might be asked to write a two page discussion of some idea in the course.