**Course Number:** Phys 4510  
**Course Title:** Optics  
**Semester:** Fall 2005

**Instructor:** C. Tim Lei (email: tim.lei@colorado.edu)  
**Grader:** Qing Li

**Lectures:** Tue&Thr 2pm to 3:15pm (G-2B60)  
**Instructor office hour:** Wed 10am to 11am (F-327) or by appointment  
**Grader help hour:** Mon 9am to 10am (exclusive optics), or Tue 3pm to 5pm (optics and others) at Dune G2B90

**Course website:** [http://www.colorado.edu/physics/phys4510](http://www.colorado.edu/physics/phys4510)

**Prerequisite courses:** Phys 3310 and Phys 3320 (Principle Electro-Magnetism 1 & 2) or instructor approved

**Textbook**  
Modern Optics  
Author: Robert D. Guenther  
Publisher: John Wiley & Sons  
Year: 1990  
ISBN: 0471605387

**References**  
1. S. Teich, Photonics  
   Wiley, 1991  
2. G. Fowles, Modern Optics  
   Dover, 1975

**Syllabus**  
1. Electromagnetic Theory & Maxwell’s Equation  
   a. Maxwell’s equation in a uniform medium  
   b. Polarization & Jone’s vector  
   c. Reflection and Refraction in boundaries  
   d. Electromagnetic waves in a conducting medium  
2. Wave propagation in inhomogenous media  
3. Guided wave optics  
   a. Wavevector model of slab waveguide  
   b. Electromagnetic analysis of planar waveguide & step-index fiber  
4. Coherence: temporal and spatial  
5. Geometrical optics  
   a. Eikonal equation and optical ray  
   b. Paraxial ray and ABCD matrix  
6. Gaussian Beam  
   a. Gaussian beam and paraxial ray
b. Gaussian beam propagation and ABCD matrix

7. Interference
   a. Interference of two waves
   b. Interference of multiply waves

8. Diffraction
   a. Huygen’s Principle and Fresnel-Kirchoff Theorem
   b. Faunhoffer diffraction
   c. Fresnel diffraction

Homework
There will be five homework assignments for the whole course, and if time allowed, I will give the class one week of time to write the assignments. Some of the homework problems require you to use a computer program to solve. Matlab will be a good choice but it is not restricted to use other mathematical programs that you prefer; however, computer programs written need to be attached with the results. Other problems should be written clearly and steps of derivation should be shown.

The 5 homework assignments will be accounted for 30% of your total grade, and each assignment will value 8% of your total grade accordingly. Discussions between classmates are allowed but copying other people’s solution is strictly prohibited. If identical solutions are found, all identical assignments will be graded zero. Homework should be turned in before the lecture of the deadline date, and 25% late penalty will be incurred if late no more than one class. Homework will not be accepted if late for more than one class.

Examinations
There will be two quizzes during the semester, and each quiz will be accounted for 20% of the final grade. The tentative dates for the two quizzes are at Oct 11th and Nov 22nd (subject to change) and each quiz is 75 minutes. The final exam is a 2 hour exam and will be at Dec 10th from 7:30am to 9:30am. The final exam will be accounted for 30% of the final grade. All exams are open book, open notes.

Classnotes and homework solutions
Instructor classnotes will be uploaded to the course website after finish teaching the chapter. Homework solutions will be uploaded to the course website after homeworks are collected from class.