PHYS 425/525: Modern Optics and Photonics (Spring 2006)
Instructor: Daniel A. Steck
Office: 277 Willamette  Phone: 346-5313  email: dsteck@uoregon.edu
Office hours: T 12:00-1:00, F 12:00-1:00, and by appointment
TA: Sasha Tavenner Kruger  email: quack@darkwing.uoregon.edu
Course home page: http://atomoptics.uoregon.edu/~dsteck/teaching/06spring/phys425

Schedule: MWF 9:00-9:50, 318 Willamette
Course reference number: 37021 (425); 37026 (524)
Credits: 4
Prerequisites: PHYS 424/524

Links: news, course notes, homework sets and keys.

Course overview
This course will provide a broad overview of Fourier optics, light-atom interactions, laser physics, and other topics in modern optics. See the tentative syllabus below for a preliminary list of topics we will cover.

Recommended Text: Fowles, Introduction to Modern Optics
There are many other excellent standard optics texts that you may find useful for this course. These will be on reserve in the science library:

Saleh and Teich, Fundamentals of Photonics
Hecht, Optics
Pedrotti and Pedrotti, Introduction to Optics
Verdeyen, Laser Electronics
Siegman, Lasers

Grades
Grades for the course will be based on homework, one mid-term exam, and a final exam. The relative weights will be as follows:

Homework: 40%
Mid-term exam: 25%
Final exam: 35%

Homework: this is a homework-intensive course. Homework will be assigned weekly and each assignment will be due in class one week after it is assigned. Thereafter, late homework will be accepted, but at a 25% penalty for each 24 hour period it is turned in late. Partial assignments may be turned in, and only the late portion will be penalized.
The relative contribution of each homework assignment to the final grade will depend on its difficulty. Additional problems will occasionally be assigned for PHYS 525 students.

Mid-term exam: I would again like to have an evening exam in lieu of one of the usual class periods (to reduce time pressure). This is scheduled for Thursday, 11 May at 6:30 pm instead of class on 24 May. (Exam to be held in 318 Willamette.)

Final exam: The final exam will be held Thursday, June 15, 10:15-12:15, in 318 Willamette.

Pass/fail grading option: a passing grade requires the equivalent of a C- grade on the homework. All exams are optional for this grading option.

Computer access
Some of the homework will require access to a computer for basic calculations (in low-level languages such as C or Fortran, or any of several higher-level packages such as Mathematica, Maple, Matlab, Octave, Mathcad, etc.) and basic plotting (e.g., GNUplot, Excel, etc.). I will use Mathematica for examples because of its availability at UO, but it is not necessarily the best choice for any particular problem. Contact the instructor as soon as possible if you do not already have access to such resources.

Syllabus
Monday       Wednesday  Friday
3 April       Fourier Analysis II: Convolution, Green’s Functions  5 April
Fourier Optics: Wave Propagation  7 April
Fourier Optics: Fraunhofer Diffraction
10 April      Fourier Optics: Fresnel Diffraction  12 April
Fourier Optics: Acousto-Optic Effect  14 April
Fourier Optics: Spatial Filtering  17 April
Fourier Optics: Holography  19 April
Fourier Analysis III: Numerics of Fourier Transforms  21 April
Statistical Optics: Coherence
24 April      Statistical Optics: Interference and Visibility  26 April
Light-Atom Interactions: Lorentz Model  28 April
Atom Optics: Light Shifts and Optical Forces
1 May
Atom Optics: Atom-Photon interactions  3 May
Atom Optics: Laser Cooling and Trapping  5 May
Optical Media: Absorption and Dispersion  8 May
Optical Media: Kramers-Kronig Relations  10 May
Optical Media: Resonant Media and Pulse Propagation  12 May
Laser Physics: Overview  15 May
Laser Physics: Gain Saturation  17 May
Laser Physics: Light-Atom Interactions  19 May
Laser Physics: Optical Gain and Pumping Schemes  22 May
Laser Physics: Output Characteristics  24 May
No Class: Evening Midterm Instead  26 May
Fiber Optics: Ray Tracing  29 May
No Class: Memorial Day  31 May
Fiber Optics: Mode Analysis  2 June
Fiber Optics: Loss and Dispersion  5 June
Photonic Bandgap Crystals: Kronig-Penney Model  7 June
Photonic Bandgap Crystals: Fabrication and Performance  9 June
Review and Evaluation
Other important dates:
Last day to drop without a W: 10 April
Last day to register: 12 April
Last day to withdraw: 21 May