PHYS 425: Modern Optics and Photonics (Spring 2013)

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Office hours: walk-in and by appointment  
Course home page: [http://atomoptics.uoregon.edu/~dsteck/teaching/13spring/phys425](http://atomoptics.uoregon.edu/~dsteck/teaching/13spring/phys425)

Schedule: MWF 9:00-9:50, 318 Willamette  
Course reference number: 35623  
Credits: 4  
Prerequisites: PHYS 424

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.

Texts: There is no required textbook for this course. Course notes will be posted on this site as the term progresses; they may be downloaded all at once here, but this document may be updated during the course.

There are many other excellent standard optics texts that you may find useful for this course, such as:

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

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

- Homework: 40%
- Mid-term exam 1: 15%
- Mid-term exam 2: 15%
- Final exam: 30%

**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.

**Mid-term exam 1:** in class, Wednesday, 24 April. If possible, I would like to reschedule this exam for an evening to reduce time pressure.

**Mid-term exam 2:** in class, Wednesday, 22 May. If possible, I would like to reschedule this exam for an evening to reduce time pressure.

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

**Pass/fail grading option:** a passing grade requires the equivalent of a C- grade on all coursework (homework and final).

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**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.

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**Syllabus**

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<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tbody>
<tr>
<td>1 April</td>
<td>3 April</td>
<td>5 April</td>
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<tr>
<td>Fresnel Relations: Conductors</td>
<td>Thin Films: Reflection Model</td>
<td>Thin Films: Matrix Formalism</td>
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<tr>
<td>8 April</td>
<td>Thin Films: Matrix Formalism</td>
<td>10 April</td>
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<td>15 April</td>
<td>Fourier Analysis II: Convolution, Green's Functions</td>
<td>17 April</td>
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<td>22 April</td>
<td>Fourier Optics: Fresnel Diffraction</td>
<td>24 April</td>
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<td>29 April</td>
<td>Fourier Optics: Holography</td>
<td>1 May</td>
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<td>6 May</td>
<td>Laser Physics: Overview</td>
<td>8 May</td>
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<td>13 May</td>
<td>Laser Physics: Optical Gain and Pumping Schemes</td>
<td>15 May</td>
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<td>20 May</td>
<td>Atom Optics: Atom-Photon interactions</td>
<td>22 May</td>
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<td>27 May</td>
<td><strong>No Class:</strong> Memorial Day</td>
<td>29 May</td>
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<td>3 June</td>
<td>Photonic Bandgap Crystals: Kronig-Penney Model</td>
<td>5 June</td>
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**Other important dates:**
- Last day to drop without a W: 8 April
- Last day to register: 10 April
- Last day to withdraw: 19 May