PHYS 424/524: Classical and Modern Optics (Winter 2006)

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Office hours: T 12:00-1:00, F 12:00-1:00, and by appointment
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Course home page: http://atomoptics.uoregon.edu/~dsteck/teaching/06winter/phys424

Schedule: MWF 9:00-9:50, 318 Willamette
Course reference number: 24011 (424); 24018 (524)
Credits: 4
Prerequisites (PHYS 424): PHYS 351-2, MATH 281-2

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

Course overview

This course will provide a broad overview of geometric optics, wave optics, and laser physics. 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
- Verdereyen, 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: 10%
- Mid-term exam 2: 20%
- 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. Additional problems will occasionally be assigned for PHYS 525 students.

Mid-term exam 1: in class, Wednesday, February 8.

Mid-term exam 2: in class, Wednesday, March 1.
Final exam: The final exam will be held Wednesday, March 22, 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

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<th>Monday</th>
<th>Wednesday</th>
<th>Friday</th>
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<tr>
<td>9 January Review of Linear Algebra</td>
<td>11 January Ray Optics: Fermat’s Principle</td>
<td>13 January Ray Optics: Matrix Formalism</td>
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<td>16 January No Class: MLK Day</td>
<td>18 January Ray Optics: Resonator Stability</td>
<td>20 January Review of Fourier Analysis</td>
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<td>30 January Wave Optics: ABCD Law for Gaussian Beams</td>
<td>1 February Wave Optics: Hermite-Gaussian Beams</td>
<td>3 February Wave Optics: Resonator Transmission</td>
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<td>6 February Wave Optics: Spherical-Mirror Resonator Modes</td>
<td>8 February Midterm Exam 1</td>
<td>10 February Polarization Optics: Jones Vectors</td>
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<tr>
<td>13 February Polarization Optics: Fresnel Relations</td>
<td>15 February Thin Films: Reflection Model</td>
<td>17 February Thin Films: Matrix Formalism</td>
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<td>20 February Thin Films: Coating Design</td>
<td>22 February Polarization Optics: Birefringent and Active Media</td>
<td>24 February Review of Fourier Analysis II</td>
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<td>27 February Fourier Optics: Diffraction</td>
<td>1 March Midterm Exam 2</td>
<td>3 March Fourier Optics: Image Formation</td>
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<tr>
<td>6 March Fourier Optics: Holography</td>
<td>8 March Review of Fourier Analysis III</td>
<td>10 March Optical Media: Absorption and Dispersion</td>
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Other important dates:
Last day to drop without a W: 16 January
Last day to register: 18 January
Last day to withdraw: 26 February