Administrivia

What: Undergraduate Optics Lab, *ECE 4606*

Who: Dr. Robert McLeod, ECE 1B47, (73)5-0997
mcleod@colorado.edu
Office hours: Tu 12-1, Th 8:30-9:30

Ramzi Zahreddine, ECEE 105
zahredrn@gmail.com
Office hours: M 11-1, Fr 10-12

Where: ECCR 265 (lecture), ECEE 105 (lab)

When: Mon 5:00-5:50 PM

Text: Introduction to Optics, 3rd edition
by Pedrotti

Reserve: http://libraries.colorado.edu/search/p?SEARCH=mcleod

Grading: Lab books
- Prelab 30%
- Lab 20%
- Post-lab 10%
- Reports (2) 20%
- Final 20%

Website: http://ece.colorado.edu/~mcleod
Legal fine print

1. If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices

2. Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. See full details at http://www.colorado.edu/policies/fac_relig.html

3. Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to such behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See polices at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

4. The University of Colorado at Boulder policy on Discrimination and Harassment (http://www.colorado.edu/policies/discrimination.html), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh

5. All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/
Grading details

- **Lab book (60%)**
  - You will record your designs, lab results and data analysis in a lab book.
    - Prelabs: You will prepare designs in order to efficiently use the lab time. The TA will critique and correct these designs in the first 10 minutes of lab in order to insure your design will work. The prelab will be graded on completeness (is *everything* specified), clarity (can the TA check your design in 60 seconds), and quality in equal measure. This is the “homework” for the class.
    - Lab documentation: You will prototype your design (i.e. do the lab) and document it in your lab book. See the website for papers on how to keep good lab books.
    - Post-lab data analysis: Record all data as tables in the lab and potentially make a neat hand-drawn plot. In some cases you will need to make neater plots or do some post-lab analysis. Complete this after lab and tape or glue-stick the results into your lab book.
  - Turn in your completed lab book in the box outside Dr. McLeod’s office on this schedule:
    - If you have lab on Tuesday, turn them in by Thursday at 5 pm
    - If you have lab on Wednesday, turn them in by Friday at 5 pm
    - If you have lab on Thursday, turn them in by Monday at 10 AM.
  - Then get started on next week’s prelab. We will grade the lab books and return them to the box by the working day before your lab at 5 PM by the latest. Pick up your lab book and copy or paste your prelab work into it before your lab time. Repeat.
- **Reports (20%)**: You will write two different kinds of papers on two labs of your choice. These will be:
  - *Journal paper*: A formal journal article for a technical audience based on the IEEE letter format.
  - *Lab/industrial report*: A report to your organization (the TA and the instructor) on the lab procedure and results.
- **Final (20%)**
Teaching goals

At the end of the class, you should:

• Have basic optics lab skills including competence in:
  – hands-on assembly and alignment
  – cleaning and safety
  – use of various instruments and
  – the keeping of a good lab book.

• Understand the application of optics to real world problems including:
  – how to design optical systems and
  – the interaction of optics and electronics

• Reinforce your theoretical knowledge of photonics including:
  – The types and capabilities of optical components and
  – common optical systems.

• You will have the opportunity to design and implement your own project in the final two lab sections. This is your chance to explore areas specifically interesting to you.
Relationship to traditional EE

Optical layer

- **Creation**
  - LEDs
  - Lasers
  - Lamps/filters

- **Modulation**
  - Liquid crystal
  - Electro-optic
  - Scanners
  - Switches

- **Transmission**
  - Wave/Fourier
  - Passive components
  - Fiber optics
  - Optical storage

- **Detection**
  - Photo-diodes
  - Photomultipliers
  - CCDs
  - Night-vision

Electrical circuit layer

- Driver circuit
- Detector circuit

Robert R. McLeod, University of Colorado
Teaching style

• Availability, in order of my preference:
  – Office hours
  – Talk to me in lab
  – Make an appointment via email
  – Drop in. I’ll usually take some time to talk to you.

• This class will not be standard:
  – Engineering students do not get enough exposure to design. With the exception of the first sequence on laser conditioning, you will be given the information you need to design the lab, but will not be given a cook-book set of steps.
  – We wish to accommodate a range of backgrounds and prereqs. You will be graded on your designs, execution in the lab and write-ups. The labs are intended to be challenging and you may not finish all steps. Grading will be weighted more towards doing a good job and less towards finishing all sections.

• I am still new at this teaching business and would appreciate your feedback at any time on the content, difficulty, speed or style of the class.
Lecture notes

• I post PDFs of my notes at least the night before class.
• These are my notes, not a textbook.
• Some helpful road-signs for those of you that miss your morning coffee:
  – The major topic being covered
  – What class you’re taking
  – Who you’re taking it from
  – The source of the material, often from our text. Go read this!
## Schedule

Subject to change – watch this space

<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Lecture</th>
<th>Lab</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>Aug</td>
<td>24</td>
<td>1 Intro</td>
<td>Lecture - from Maxwell to optics</td>
<td>4</td>
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<tr>
<td></td>
<td>31</td>
<td>2 Imaging 1</td>
<td>1 Basic skills - how to make a plane wave</td>
<td>1</td>
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<tr>
<td>Sept</td>
<td>7</td>
<td>3 Imaging 2</td>
<td>2 Imaging 1: Telescope</td>
<td>2</td>
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<td></td>
<td>14</td>
<td>4 Fourier</td>
<td>3 Imaging 2: Microscope</td>
<td>3</td>
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<td></td>
<td>21</td>
<td>5 Interferometry</td>
<td>4 Fourier optics</td>
<td>21</td>
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<tr>
<td></td>
<td>28</td>
<td>6 Polarization</td>
<td>6 Interferometry and coherence</td>
<td>7,8,9</td>
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<tr>
<td>Oct</td>
<td>5</td>
<td>7 Holography</td>
<td>7 Polarization</td>
<td>14,15</td>
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<tr>
<td></td>
<td>12</td>
<td>8 Spectroscopy</td>
<td>5 Holography</td>
<td>16</td>
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<td></td>
<td>19</td>
<td>9 Detectors</td>
<td>8 Grating spectroscopy</td>
<td>12</td>
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<td>26</td>
<td>10 Emitters</td>
<td>9 Photodiodes</td>
<td>17</td>
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<tr>
<td>Nov</td>
<td>2</td>
<td>11 Driver circuitry</td>
<td>10 Laser diodes &amp; LEDs</td>
<td>6</td>
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<td></td>
<td>9</td>
<td>12 Optical com</td>
<td>11 Photoreceiver design</td>
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<td>16</td>
<td>13</td>
<td>12 Optical communication</td>
<td>10</td>
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<td>23</td>
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<td>Fall Break</td>
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<td>30</td>
<td>14</td>
<td>13 Independent project 1</td>
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<tr>
<td>Dec</td>
<td>7</td>
<td>15</td>
<td>14 Independent project 2 / make up</td>
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Note: Spectroscopy has been pushed back so that the spatially-filtered laser set-ups can all be used in a single block.