OPTI 511L, Lasers & Solid State Devices

Fall 2012

Class lectures Mondays, 2-2:50 pm
Class Location: Meinel 432
Lab location: Meinel 452

Class Website: www.optics.arizona.edu/opti511l/ (lab write-ups posted here)

Instructor:

Prof. R. Jason Jones

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Lab: Meinel 578
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Office hours: During scheduled lab sessions. You can usually find me either in my office or the 511L lab. You are welcome to come by my office or schedule an appointment.

TA
Christian Lytle

Course Structure

This course consists of weekly lectures (Mondays) and ~6 lab projects to complete during the weekly lab sessions. For the lab sessions, the class will be divided into groups of 3 students each, with each group meeting at a scheduled time once each week (with the TA) for up to 3 hours to work on the lab project assigned for that week.

For each lab project there will be a handout covering experimental objectives, procedures, and topics to explore. Fundamental concepts related to the labs will be reviewed and discussed in the Monday lectures prior to the labs.

Each student needs to acquire a lab notebook to use for recording data and observations while working in the lab. Please purchase a composition notebook (no spiraled notebooks or 3-ring binders please). If the pages are not numbered, please number the pages and reserve the first page as a Table of Contents to record (at least) the starting page for each lab section. The objective of the lab book is to provide you, by the end of the semester, with a helpful reference to concepts, calculations, and observations you made during the course. It may be helpful to put useful formulas (e.g. Gaussian beam parameters) in the first several pages of the notebook or each lab section for reference. However, please do not use this as a notebook for lectures.

Course Objectives

The objectives of 511L are to illuminate through experiment many of the principles covered in OPTI 511R, to learn about fundamental principles of laser operation, to gain experience working with a few different types of lasers, to learn techniques of laser light manipulation, and to explore a few laser applications. These objectives will be accomplished through the following labs (not in any particular order):

Gaussian beam modes and optical cavities (first 3 weeks).
Nonlinear Optics
Argon-ion Lasers and Optical Tweezers
Fundamentals of Mode-locked Lasers
Semiconductor Diode Lasers
Saturation Spectroscopy
Magneto-Optical Trapping and Cooling of Rb Atoms

References (not required)

Fundamentals of Photonics, Saleh and Teich
Quantum Electronics, Amnon Yariv,
Laser Electronics, Joseph T. Verdeyen,
Lasers, A. Siegman,
Lasers, Milonni and Eberly.

Grade Policy

Grades will be based on the following:

Lab Participation:	40%
Lab Notebooks:	30%
Lab Reports:	30%

Grading policy: A: 90-100 % , B: 80-90%, C: 70-80%

- *Participation in each project.* ***Full participation in each lab session*** is a ***required*** part of this course. This does not mean you need to excel at setting up laser-based experiments. Rather, you need to make serious efforts towards contributing to each project. *Please understand that successfully completed experiments are not required for a good grade.* Experiments often fail for many reasons, and it is usually more beneficial to understand why an experiment did not work as expected than to not understand why an experiment did work. Please note that due to the structure of this course, lab sessions can generally not be made up at a later point during the semester. **If you foresee an absence from your weekly lab meeting, you need to discuss it with me *beforehand*** to search for an alternative time during the week to participate in the experiment with another lab group, or better yet, arrange to swap places with someone in another lab group.

-*Lab Notebooks.* For each of the labs, you will be required to record data in your lab notebook and answer questions asked in the handouts (record answers in your lab notebook). I will expect you to maintain legible and complete records of experiment setups, observations, data collected, experiments tried, results obtained, and answers to questions asked in the handouts. Be sure to make careful sketches of the experimental setup. **There may be pre-lab or post-lab questions assigned. It is required that these are recorded in your lab notebook.** I may collect the lab notebooks once or twice during the semester (I will notify you in advance) for evaluation.

- *Lab Report*. There will be ~1-3 lab reports required during the semester. This will be a clearly written summary based on a detailed analysis of a lab and/or topic covered in the course. More details will be discussed in class.

Working in the laboratory

Please show up on time. **- You are expected to be familiar with the principles discussed in class and in the lab handouts *before* working on the experiments.**

-*You should not plan on relying on your lab partners or your TA to walk you through all of the concepts and procedures of an experiment*. This may mean that you need to spend some time reviewing fundamental concepts discussed in the Monday lectures or the lab handouts. A good understanding of concepts will be extremely beneficial when working in the lab.

- *Lasers can be dangerous tools*. Some of the lasers you will be using can burn your skin, or permanently damage your eye if the beam is pointed directly into your eye. This can inadvertently happen during laser beam alignment with mirror and lenses. *Laser safety eyewear is provided and should be worn as needed.* Furthermore, watches, rings, and other reflective objects and jewelry that can obstruct a laser beam and reflect light into your eyes or your partners' eyes can be removed prior to laser work. You and your lab partners should watch out for each other, and remind each other of laser safety precautions. ***No rules can replace good common sense in a laser laboratory, please use it!***