



CREOL  
The College of Optics and Photonics  
University of Central Florida

## OSE 4520L: Laser Engineering Laboratory

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### COURSE SYLLABUS

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Instructor: Dr. Patrick LiKamWa  
Office: CREOL A211  
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E-Mail: [patrick@creol.ucf.edu](mailto:patrick@creol.ucf.edu)  
Office Hours: Wednesdays: 12:30 PM – 2:30 PM, and by appointment

Term: Spring 2016  
Class Meeting Days: Fridays  
Class Meeting Time: 12:30 - 3:30 PM  
Class Location: CREOL A210

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Graduate Teaching Assistant: Parinaz Aleahmad  
Office: CREOL 214  
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Office Hours: Mon, Wed: 11:30 AM – 1:00 PM, and by appointment

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#### I. University Course Catalog Description

Experiments highlighting basic laser phenomena. The photon nature of light. Absorption and spontaneous and stimulated emission of light. Fluorescence. Optical amplifiers. Optical resonators. Lasers. Pulsed lasers. Nonlinear optical wave conversion.

#### II. Course Overview

This is a laboratory course that is designed to give students hands-on experience in aligning, characterizing and analyzing lasers and generally understanding the principle of the laser. Students will work in small teams performing to build small lasers and laser systems in order to gain experience in building lasers, understanding the various types of output they can deliver and manipulating and applying laser beams. Through these experimental projects, students are introduced to most of the major concepts covered in the course, including: photons; emission; laser cavities and modes; laser threshold; laser beams, focusing and collimation; and second harmonic generation.

#### III. Course Learning Objectives

Upon completion of this course, the student will be able to:

1. Be able to align a basic laser cavity.
2. Know how to make a laser run on a single transverse mod
3. Be able to characterize a laser beam
4. Know how to measure laser power and determine laser irradiance
5. Explain the difference between single and multiple spatial modes lasers and know how to approach focusing and collimation in each case.
6. Be able to measure the spectral output of a laser.
7. Explain laser diode-pumping and second harmonic generation

#### IV. Course Prerequisites

Be currently enrolled in OSE 4520 Laser Engineering.

**V. Credits**

1 (3-0)

**VI. Course Texts**

Laser Fundamentals, W. Silfvast, Cambridge

Laser Electronics, 3rd ed., J. T. Verdeyen, Prentice-Hall, .

Fundamentals of Photonics, 2nd edition B. Saleh and M. Teich, Wiley, 2007

**VII. Course Requirements**

- The student is expected to review the textbooks, notes, and the lab handout; and come to lab prepared to perform the scheduled experiment.
- All experimental procedures, observations, data, and measurements during the laboratory session must be properly documented in the provided laboratory manual / handbook. All entries must be in ink. The lab manual / notebook will be collected at the end of each lab session.

Each student is expected to maintain a three ring binder

**VIII. Course Grading**

Course Item	Percent of Final Grade
Laboratory Participation	18%
Lab Notebook Completeness	30%
Draft Lab Report	17%
Final Lab Report	35%
	100%

- Lab manuals / notebooks will be collected at the end of the class. If the instructor deems the work to be incomplete the student may be asked to stay and complete the work or a grade point will be deducted.
- The Lab reports (draft and final) must be submitted through Webcourses at <http://webcourses.ucf.edu/> by 12:00 am of the day they are due.
- Lab reports sent via email or hard copy will NOT be accepted.
- Absences and Makeup Lab Sessions:
  - Because of the fluid nature of the lab with the experimental setup changing every week, there will be NO MAKEUPS ALLOWED except in cases of genuine emergency.
  - With prior arrangements, students may be allowed access to the lab after the class and before Thursday at 3:00 pm of the same week.
- The instructor reserves the right to change or modify any portion of this schedule without prior notice or recourse by the students.

### IX. Guide for Preparing Lab Reports:

The objective of the lab is to understand fundamental concepts related to photonics, explore physical phenomena in a laboratory setting, make careful measurements, and draw your own conclusions about the models and theories which are supposed to describe these phenomena. The lab report should reflect these objectives.

#### Content:

The report should include the following sections (as appropriate):

- Objective:** State purpose or objective of the lab session or experiment.
- Theory:** Provide an approximately one page brief summary of concepts and relationships involved. Necessary equations or formulae are to be stated and referenced.
- Experiment setup:** List equipment used with sketches where appropriate.
- Procedure:** Summarize experimental procedure and measurement techniques.
- Results:** Present raw data, calculations, numerical modeling of experimental results when appropriate.
- Error Analysis:** Comment as to the magnitude and origin of uncertainty of the raw experimental measurements and discuss how these raw uncertainties propagate to affect the final calculated results. If data is suspect, discuss possible flaws in technique or measurements.
- Discussion:** Discuss the specific topics provided at the beginning of lab description.
- Conclusions:** Summarize results in a concise manner and state conclusions.

#### Format:

- The lab report must be in word or pdf format with type size 12 and one inch margins.
- The report must be informative and well organized with clearly labeled graphics and defined symbols.
- For additional information and tips, please see: Christopher S. Lobban & Maria Schefter, Successful Lab Reports: A Manual for Science Students (Cambridge: Cambridge University Press, 1992) or search the web with the quoted phrase "How to Write a Lab Report".

#### Guidelines for lab notebook grading:

Item	Score (%)
Organization, neatness and readability of informal notes	25%
Correctness and presentation of results (Including, where appropriate, tables, plots, error analysis)	35%
Depth and conciseness of answers to Discussion and Analysis questions)	25%
Responses in complete sentences and paragraphs.	15%
<b>Total</b>	<b>100%</b>

### X. Grading Objections

All objections to grades should be made IN WRITING WITHIN ONE WEEK of the work in question. Objections made after this period has elapsed will NOT be considered – NO EXCEPTIONS.

### XI. Professionalism and Ethics

Academic dishonesty in any form will not be tolerated. If you are uncertain as to what constitutes academic dishonesty, please consult The Golden Rule, the University of Central Florida's Student Handbook (<http://www.goldenrule.sdes.ucf.edu/>) for further details. As in all University courses, The Golden Rule Rules of Conduct will be applied. Violations of these rules will result in a record of the infraction being placed in your file and the student receiving a zero on the work in question AT A MINIMUM. At the instructor's discretion, you may also receive a failing grade for the course. Confirmation of such

incidents can also result in expulsion from the University.

It is the nature of a laboratory course that you will be working in groups. Obviously, those of you who are lab partners will be using the same raw data. You are encouraged to discuss your observations and insights with your lab partners; however, each of you has to write your own ORIGINAL lab reports.

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### **DEFINITIONS**

**Cheating:** any unauthorized assistance in graded, for-credit assignments.

**Plagiarism:** appropriating the work of others and claiming, implicitly or explicitly, intentionally or unintentionally, that it is your own.

With increased use of the internet, digital plagiarism is becoming more of a problem on campuses everywhere. You are encouraged to use the internet; however, electronic copying and pasting of material directly into reports and papers without proper reference of the source is blatant plagiarism. ALWAYS REFERENCE THE SOURCES OF INFORMATION.

Providing a fellow student with experimental data from an experiment in which he/she did not participate is also forbidden. All parties that are involved in such practice will be reported to UCF Office of Student Conduct (OSC).

If there is any question concerning acceptable practice in this laboratory course, don't hesitate to ask the instructor.

### **XII. Students with Special Testing/Learning Needs**

Students with special needs and require special accommodations must be registered with UCF Student Disability Services prior to receiving those accommodations. Students must have documented disabilities requiring the special accommodations and must meet with the instructor to discuss the special needs as early as possible in the first week of classes. UCF Student Disability Services can be contacted at <http://www.sds.sdes.ucf.edu/>, or at (407)823-2371.

### **XIII. Excusal from Course Assignments and Course Examinations**

If an emergency arises and a student cannot submit assigned work on or before the scheduled due date or cannot take an exam on the scheduled date, the student MUST give notification to the instructor NO LESS THAN 24 HOURS BEFORE the scheduled date and NO MORE THAN 48 HOURS AFTER the scheduled date.

### **XIV. Class Attendance and Participation**

- Regular class attendance is mandatory.
- Please be on time to class.
- Students in attendance are expected to be active participants in the course.

*Note: The instructor reserves the right to modify the information contained in this document at his discretion.*



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### **COURSE SCHEDULE**

<b>Week</b>	<b>Day</b>	<b>Date</b>	<b>Topic</b>
1	Fri	Jan 15	Instructor Introduction; Course Overview (ALL)
2	Fri	Jan 22	HeNe (Gas) Laser (Group A)
3	Fri	Jan 29	HeNe (Gas) Laser (Group B)
4	Fri	Feb 5	Diode Laser (Group A)
5	Fri	Feb 12	Diode Laser (Group B)
6	Fri	Feb 19	Nd:YAG crystal (Group A)
7	Fri	Feb 26	Nd:YAG crystal (Group B)
8	Fri	Mar 5	Lecture (Instructions on Lab Report Requirements) (ALL)
9	Fri	Mar 12	Spring Break (No Class)
10	Fri	Mar 19	Diode Pumped Nd:YAG Laser (Group A)
11	Fri	Mar 26	Diode Pumped Nd:YAG Laser (Group B)
12	Fri	Apr 2	Laser Pulses (Group A)
13	Fri	Apr 9	Laser Pulses (Group B)
14	Fri	Apr 16	Nonlinear Frequency Generation (Group A)
15	Fri	Apr 23	Nonlinear Frequency Generation (Group B)
16	Fri	Apr 30	(Final Report due by ALL)

*Note: The dates of the topics are subject to change depending upon how things progress during the course of the semester*