



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  
Phone: 407-823-3816  
E-Mail: patrick@creol.ucf.edu  
Office Hours: Tue: 12:30 PM – 2:30 PM, and by appointment

Term: Spring 2014  
Class Meeting Days: **Thu**  
Class Meeting Time: **4:30 - 6:30 PM**  
Class Location: **CREOL A210**

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Graduate Teaching Assistant: Parinaz Aleahmad  
Office: CREOL 214  
Phone: 407-823-6916  
E-Mail: parinaz.aleahmad@creol.ucf.edu  
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. Align a basic laser cavity.
2. Know how to make a laser run on a single transverse mod
3. 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. Measure the spectral output of a laser.
7. Explain laser diode-pumping and intracavity second harmonic generation

#### **IV. Course Prerequisites**

Be currently enrolled in OSE 4520 Laser Engineering.

**V. Credits**  
1 (2-0)

**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.
- A bound pre-numbered laboratory notebook must be used to properly document all experimental procedures, observations, data, and measurements during the laboratory session. All entries must be in ink. The notebook must be dated and signed by the lab instructor. Raw data may be processed later. Lab notebooks will be examined periodically and collected at the end of the semester.
- A type-written, clear, and informative laboratory report (in word or pdf format) must be prepared for each experiment. The report must include, the experiment title, objective, introduction and theory, experimental method, results and data analysis, observations, conclusions, and references.

**VIII. Course Grading**

<b>Course Item</b>	<b>Percent of Final Grade</b>
Laboratory Participation	30%
Quizzes	20%
Lab Reports	50%
	100%

- Lab notebooks will be examined periodically and collected at the end of the semester.
- Lab reports must be submitted through Webcourses at <http://webcourses.ucf.edu/> by 12:00 am of the next Thursday after the experiment is completed.
- 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:

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..

#### 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 report grading:

- 10 Perform the experiment mechanically correct, obtain acceptable results, and submit an exemplary report in which you exhibit profound and exalted insight.
- 9 Perform experiment mechanically correct, obtaining acceptable results. Submit nice report exhibiting significant physical insight.
- 8 Submit a complete report exhibiting only minor errors and run-of-the-mill inspiration.
- 7 Submit a report containing imperfections (either incomplete or containing incorrect statements).
- 6 Report exhibits major errors or omissions.
- 0-5 Poor report

### 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

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.

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.

#### **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

Week	Day	Date	Topic
1	Thu	Jan 9	Instructor Introduction; Course Overview (All)
2	Thu	Jan 16	HeNe (Gas) Laser (Group A)
3	Thu	Jan 23	HeNe (Gas) Laser (Group B)
4	Thu	Jan 30	Diode Laser (Group A)
5	Thu	Feb 6	Diode Laser (Group B)
6	Thu	Feb 13	Nd:YAG crystal (Group A)
7	Thu	Feb 20	Nd:YAG crystal (Group B)
8	Thu	Feb 27	Diode Pumped Nd:YAG Laser (Group A)
9	Thu	Mar 13	Diode Pumped Nd:YAG Laser (Group B)
10	Thu	Mar 20	Laser Pulses (Group A)
11	Thu	Mar 27	Laser Pulses (Group B)
12	Thu	Apr 3	Nonlinear Frequency Generation (Group A)
13	Thu	Apr 10	Nonlinear Frequency Generation (Group B)
14	Thu	Apr 17	Dissecting a Commercially Packaged Laser (All)
15	Thu	Apr 24	Final Exam (All) (Submit final report online) and Collection of Laboratory Notebooks

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