



CREOL OSE 6526C: Laser Engineering Lab
College of Optics and Photonics, Spring 2018
University of Central Florida

COURSE SYLLABUS

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|---------------|---|-----------------|----------------|
| Instructor: | Dr. Konstantin Vodopyanov | Term: | Spring 2018 |
| Office: | CREOL Room A113 | Class Days: | Mondays |
| Phone: | 407 823 6818 | Class Hours: | 4:30 - 9:00 pm |
| E-Mail: | vodopyanov@creol.ucf.edu | Class Location: | Room 265 |
| Website: | http://www.creol.ucf.edu/People/Details.aspx?PeopleID=9927 | | |
| Office Hours: | Fridays, 5-6 pm | TA: Evan Hale | |

I. Welcome!

Welcome to CREOL OSE 6526C course: Laser Engineering Lab.

II. University Course Catalog Description:

The goal of this hands-on course is to obtain good practices of laser experiment. You will learn how to build a solid-state laser from scratch! In addition, you will learn how to acquire, process, and interpret experimental data and write a report in a format of a scientific paper.

III. Course Overview:

The course consists of a sequence of six interconnecting experiments based on a diode-pumped solid-state Nd:YAG laser. The experiments will be carried out in groups of two. In laboratory sessions students will learn the practical aspects of handling optics, laser tuning and laser diagnostics – something that is not usually taught in a classroom course.

The students will first get some acquaintance with a working laser: they will evaluate stability and sensitivity of the laser operation with respect to alignment of the laser mirrors and with respect to changing the laser cavity length. Then they will build (starting from Lab work 2) their own solid-state laser from scratch, beginning with characterizing a laser diode that will be used as a pump source. The students will measure efficiency of the laser they have built, perform second harmonic (green) generation, and study the efficiency of the second harmonic generation process as a function of different factors. The students will also study giant-pulse (Q-switched) Nd:YAG laser operation as well as laser build-up dynamics when the diode pump is abruptly turned on.

During the course, the students will learn how to record, process and interpret experimental data. The students are expected to make notes in laboratory notebooks. The use of computers in the laboratory

(and software such as Excel, Origin, Matlab and other) is encouraged. In addition, students are encouraged to perform independent literature searches to find explanations to their experimental findings.

The course is suitable for the first-time users of lasers, though students must have an understanding on how the lasers work. Because of equipment and space limitations, participation is capped at 12 students (6 teams of two). Classes are held once a week in 4.5-hour sessions. Total there will be 6 experiments with two sessions (two weeks) allocated per each experiment.

IV. Course Prerequisites:

OSE6525 - Laser Engineering or other approved Laser Courses

V. Course Credits:

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VI. Reference Textbooks:

- *Lasers*, Anthony E. Siegman, University Science Books, c1986
- *Quantum Electronics*, A. Yariv, John Wiley & Sons, 1989.
- *Principles of Lasers*, O. Svelto, Springer, 2010
- *Laser fundamentals*, William T. Silfvast, Cambridge University Press, 1996.
- *Laser electronics*, Joseph T. Verdeyen, Prentice Hall, 1989.
- *Wikipedia*

VII. Basis for Final Grade:

| Assessment | Percent of Final Grade |
|-------------|------------------------|
| Lab Reports | 100% |
| | 100% |

Grading scale:

| Grading Scale (%) | |
|-------------------|---|
| 90-100 | A |
| 80 - 89 | B |
| 70 - 79 | C |
| 60 - 69 | D |
| 0 - 59 | F |

VIII. Lab Reports

Lab reports should be submitted as *pdf* files in a special (*Optics Letters* style) format (template is posted in *Webcourses 'Files'*), no later than 11:59 pm on Sunday of the 2-nd week for each experiment. A team of two students does each experiment, however each student writes his/her own report

(experimental data may be shared). There will be a reduction in the grade of 10% per day for late submissions.

IX. Grade Dissemination

You can access your scores using UCF *Webcourses*.

X. Course Policies: Grades

Late Work Policy: As a rule, there are no make-ups for the laboratory work. The lab work needs to be done only during allocated hours.

Grades of "Incomplete":

The current university policy concerning incomplete grades will be followed in this course. 'Incomplete' grades are given only in situations where *unexpected emergencies prevent a student from completing the course and the remaining work can be completed the next semester*. Instructor is the final authority on whether you qualify for an 'incomplete'. Incomplete work must be finished by the end of the subsequent semester or the "I" will automatically be recorded as an "F" on your transcript.

XI. Course Policies: Technology and Media

Email: Please use email vodopyanov@creol.ucf.edu for all correspondence.

Website: All information concerning the course will be posted on *Webcourses*. This site will reflect latest changes and contain assignments for the coming lab work

XII. Course Policies: Student Expectations

Disability Access: The University of Central Florida is committed to providing reasonable accommodations for all persons with disabilities. Students with disabilities who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations. No accommodations will be provided until the student has met with the professor to request accommodations. Students who need accommodations must be registered with Student Disability Services, Student Resource Center Room 132, phone (407) 823-2371, TTY/TDD only phone (407) 823-2116, before requesting accommodations from the professor.

Attendance Policy:

- Students must be on time to class and be prepared (i.e. they are supposed to read the Lab Notes before the class starts).
- If missed a class (for a good cause), it is the responsibility of the student to arrange with a TA an extra time for doing experiment. One extra week at the end of semester will be allocated in case students want to redo any experiment and get a better grade.

Professionalism Policy:

Per university policy and classroom etiquette: mobile phones etc. **must be silenced** during all classroom lectures. Those not heeding this rule will be asked to leave the classroom immediately so as to not disrupt the learning environment. Students who habitually disturb the class by talking, arriving late, *etc.*, and have been warned may suffer a reduction in their final class grade.

Academic Conduct Policy:

Academic dishonesty in any form will not be tolerated. As in all University courses, The Golden Rule of Conduct will be applied. Violations of these rules will result in a record of the infraction being placed in your file and 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.

XIII. Important Dates to Remember

Drop/Swap Deadline: Jan 11, 2018

XIV. Schedule 2018

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|-----------|----------------|---|
| 1 | 8-Jan | Introduction to the Laser Lab. Course logistics. Lab. Work 1: Mode characterization of a laser, part I |
| | 15-Jan | Holiday. Martin Luther King Jr. Day, no class |
| 2 | 22-Jan | Lab. Work 1: Mode characterization of a laser, part II |
| | 29-Jan | No class: the instructors will attend Photonics West Conference in San Francisco |
| 3 | 5-Feb | Lab. Work 2: The laser diode, part I |
| 4 | 12-Feb | Lab. Work 2: The laser diode, part II |
| 5 | 19-Feb | Lab. Work 3: The Nd:YAG laser, part I |
| 6 | 26-Feb | Lab. Work 3: The Nd:YAG laser, part II |
| 7 | 5- Mar | Lab. Work 4: Second harmonic generation, part I |
| | 12- Mar | Spring Break, no class |
| 8 | 19- Mar | Lab. Work 4: Second harmonic generation, part II |
| 9 | 26-Mar | Lab. Work 5: Q-Switching of Nd:YAG laser, part I |
| 10 | 2-Apr | Lab. Work 5: Q-Switching of Nd:YAG laser, part II |
| 11 | 9-Apr | Lab. Work 6: Relaxation Oscillations, part I |
| 12 | 16-Apr | Lab. Work 6: Relaxation Oscillations, part II |
| 13 | 23-Apr | Optional: you can redo any of your experiments and improve your grades |
| 14 | 2-May | Final Grades will be posted |
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