

# OSE 4410: Optoelectronics

## COURSE SYLLABUS

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Instructor: Dr. Kyle Renshaw

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Office Hours: Wednesdays 11:30 am - 12:30 pm, and by appointment

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Term: Spring 2019

Class Meeting Days: **Mon/Wed/Fri**

Class Meeting Time: **10:30 am– 11:20 am**

Class Location: **CREOL 102/103**

### I. University Course Catalog Description

Introduction to the principles and design of semiconductor optoelectronic devices including photodiodes, solar cells, light-emitting diodes, laser diodes, and CCDs. Applications include photovoltaics, displays, photodetection, and optical communications.

### II. Course Overview

This course is an introduction to the principles, design, and applications of optoelectronic devices. The course begins with a description of the interaction of light with semiconductor materials in a p-n junction configuration. This includes the phenomena of absorption, electroluminescence, and stimulated emission. The distinction between direct and indirect compound semiconductor materials is noted. Basic devices are then described: photodiodes, light emitting diodes (LEDs), semiconductor optical amplifiers, and laser diodes are then described. Array detectors, including complementary metal-oxide-semiconductor (CMOS) and charge-coupled devices (CCD) arrays, and array LEDs are then introduced. Basic specifications and applications of each of these devices are described, including solar cells, imaging with array detectors, and LED displays.

### III. Course Learning Objectives

Upon completing this course, the students will demonstrate:

- Knowledge of semiconductor materials used in optoelectronics
- Understanding of the mechanisms of light absorption and emission in p-n junctions
- Ability to interpret common specifications of photodiodes, LEDs, and laser diodes sufficient to design simple optoelectronic circuits
- Describe common designs of array detectors and LED arrays.

### IV. Integrated Learning

MATLAB is a critical computational tool for scientists and engineers. The PSE program has adopted teaching and using MATLAB throughout the curriculum. This course expects basic competency in MATLAB sufficient to use the software for homeworks, quizzes or exams. Some examples will be given in MATLAB and some homeworks will require MATLAB computations. While little MATLAB instruction is provided formally in the course, the instructor is available to help with any problems you may encounter.

**V. Course Prerequisites**

EEE 3350 Semiconductor Devices I, OSE 3052 Introduction to Photonics

**VI. Credits**

3

**VII. Course Texts**

Optoelectronics and Photonics: principles and practices, Second Edition S.O.Kasap

**IX. Course Grading**

| <b>Course Item</b>  | <b>Percent of Final</b> |
|---------------------|-------------------------|
| Class Participation | 5%                      |
| Quizzes             | 5%                      |
| Homework            | 30%                     |
| Midterm(s)          | 25%                     |
| Final Exam          | 35%                     |
|                     | 100%                    |

**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.

**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. This includes copying homework solutions.

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.

**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 and Make Up Policy**

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 or deadline.

**XIV. Class Attendance and Participation**

Regular class attendance is mandatory.

Students in attendance are expected to be active participants in the course.

**Academic Activity:** As of Fall 2014, all faculty members are required to document student's academic activity at the beginning of each course. In order to document that you began this course, please complete the provided academic activity by the end of the first week of classes or as soon as possible after adding the course. Failure to do so will result in a delay in the disbursement of your financial aid.

**XV. Teaching vs. Learning**

Most people learn things for themselves. As a teacher, my job is to help students to learn the material. In order to help you learn in depth, I will use class time to introduce the material/concepts and work examples using these concepts to solve problems. It is your responsibility to learn the material and much of this learning will come outside of class time, e.g. by working homework problems, studying for quizzes/exams and discussing concepts or problems with fellow students and myself. Students are expected to read and understand the textbook in addition to attending class. I will occasionally set quizzes to ensure that students come to class prepared.

**XVI. Homework Policy**

All homework must be submitted electronically as a ".pdf" file through the class website.

You can easily scan your homework using one of the copiers around CREOL. Late homework will be accepted with a penalty of 10 points lost per day the assignment is late.

**XVII. Class Website**

Materials used for classes will be available on UCF Webcourses for download before each class. You must print them if you want a hard copy of slides, notes or reading material.

### **XVIII. Important Dates and Schedule**

|                            |                            |
|----------------------------|----------------------------|
| First Day of Class:        | 1/6/2020                   |
| Last Day to Drop Classes:  | 1/9/2020                   |
| Withdrawal Deadline:       | 3/20/2020                  |
| Last Day of Class:         | 4/17/2020                  |
| Martin Luther King Jr. Day | 1/20/2020                  |
| Spring Break (no class)    | 3/9 - 3/13/2020            |
| Midterm Day 1              | 3/4/2020                   |
| Midterm Day 2              | 3/6/2020                   |
| Final Exam:                | 4/27/2020,<br>10am-12:50pm |

**Final Exam: April 27<sup>th</sup> from 10am-12:50pm in CREOL 102/103**

#### **Course Schedule:**

|                     |   |
|---------------------|---|
| Jan 6-19            | Introduction and Physics of Semiconductors- Chapter 3 |
| Jan 20 - Feb 2      | pn Junctions- chapter 3                               |
| Feb 3 - Feb 9       | LED- chapter 3  |
| Feb 10 - Feb 23     | Laser- Chapter 4                                      |
| March 4 & 6         | Midterm   |
| March 7 – March 15  | Spring Break  |
| March 16 – March 29 | Photodiode-Chapter 5                                  |
| March 30 – April 5  | Noise- Chapter 5                                      |
| April 6 – April 19  | Photovoltaics- Chapter 6                              |

*Schedule of topics are subject to change as needed.*