OSE 5414

Fundamentals of Optoelectronic Devices

College of Optics and Photonics, University of Central Florida

COURSE SYLLABUS

Instructor:	Ryan Gelfand	Term:	Fall 2017
Office:	CREOL A213	Class Meeting Days:	Monday/Wednesday
Phone:	407-823-1385	Class Meeting Hours:	3:00 – 4:15
E-Mail:	ryan5@creol.ucf.edu	Class Location:	CREOL A214
Website:	https://webcourses.ucf.edu	Office Hours:	Monday/Wednesday 4:15 – 6:00

I. University Course Catalog Description

Fundamentals of Optoelectronic Devices: Operation, methods of fabrication, applications, and limitations of various optoelectronic devices including quantum well semiconductor devices.

II. Course Overview

This course aims at covering the physics and engineering issues that define the basic semiconductor optoelectronics devices. We start off with learning about the material properties of bulk crystals and define the concept of an energy band for the electrons and holes in semiconductors using fundamental quantum mechanics; then we relate the energy of the free electrons to the materials' electrical and optical properties. The behavior of p-n junctions and other barrier potentials in semiconductor structures are analyzed. These junctions are presented as simple instruments that enable electrical injection of electrons with excess potential energy for radiative emission of photons. In reverse, these same junctions cause photo-generated electrons to drift rapidly across the field to generate a photocurrent. Semiconductor optoelectronic devices such as the LED, the laser diode, the photodetector are presented as mere converters of electrical energy to photon energy and vice-versa. The course contains a good mix of the electrical properties and optical properties of semiconductors and the interplay between photons and the free electrons within.

III. Course Objectives and Outcomes

The students will have a basic understanding of solid state physics as applied to semiconductor optical devices. There will be detailed discussions about the characteristics, operation, and limitation of these devices. The students will be able to use the knowledge gained in this course to further their research and also to take more advanced classes in thin film optoelectronics and semiconductor lasers.

IV. Course Prerequisites

Graduate Standing or C.I.

V. Course Credits

3 (3,0)

VI. Required Texts and Materials

Semiconductor Physics and Devices: Basic Principles 4th edition, Donald A. Neamen

VII. Topics Covered

- Crystal Structure of Solids

- Introduction to Quantum Mechanics
- Introduction to the Quantum Theory of Solids
- The Semiconductor in Equilibrium
- Carrier Transport Phenomena
- Nonequilibrium Excess Carriers in Semiconductors
- The PN Junction
- The PN Junction Diode
- Metal-Semiconductor and Semiconductor Heterojunctions
- Optical Devices
    - Optical Absorption
    - Solar Cells
    - Photodetectors
    - Photoluminescence and Electroluminescence
    - Light Emitting Diodes
    - Laser Diodes

VIII. Basis for Final Grade

Provide a listing of assessments and their weighting in the semester total. In addition to (or even in lieu of) tests, consider exploring "authentic" assessments, which are based as closely as possible to real world experiences.

Assessment	Percent of Final Grade
Homework	20%
Midterm	30%
Final Project	20%
Final	30%
	100%