CREOL
The College of Optics and Photonics

Course Syllabus

OSE 5414 (3,0) Fundamentals of Optoelectronic Devices

Instructor: Patrick LiKamWa
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Office: A-211
Office Hours: Mondays 4:15pm – 5:45pm
Wednesdays 8:00am – 9:30am

Term: Fall 2015
Class Meeting Days: Mondays & Wednesdays
Class Meeting Time: 3:00pm - 4:15pm
Class Location A-214
Website: https://webcourses.ucf.edu/

Additional Notes: I will be in my office at these times, but of course I will be happy to discuss the material with you anytime. Often, I get questions via e-mail that can be quickly answered.

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

Prerequisites: Graduate Standing or C.I.

Detailed Course Description and Learning Outcomes:

Detailed Description:
Apply the fundamentals of semiconductors solid state physics in understanding the operation of optoelectronic devices. The methods of fabrication, the applications and limitations of various optoelectronic devices will be covered. Special properties of quantum well semiconductors and devices that use them, will be also be covered

Learning Outcomes:
- Understand the relationship between the electron and the photon
- Realize the importance of energy barriers in semiconductors at p-n junctions for electron to photon conversions.
- Conceptualize the core principles underlying the operation of basic optoelectronic devices such as the LEDs, Laser Diodes and Photo Detectors.

Topics: (A detailed schedule with dates follows at the end of this document.)
See Website

Textbook: None Required

Recommended Reference:

Semiconductor Optoelectronic Devices by Pallab Bhattacharya, Prentice Hall, Englewood Cliffs, NJ.
Optoelectronics by E. Rosencher & B. Vinter, Cambridge University Press.
Photonics by Amnon Yariv and Pochi Yeh, Oxford, Oxford University Press.
Physics of Semiconductor Devices by S.M. Sze and Kwok K. Ng, New York, Wiley-Interscience.
Fundamentals of Photonics by Bahae Saleh, New York, Wiley.
Photonic Devices by Jia-ming Liu, Cambridge University Press.
Physics of Photonic Devices by Shun Lien Chuang, New York, Wiley.

Other Reference Books: any other semiconductor book.

Course Grading and Requirements for Success:

Homework: six (2) total **(**10%)
Exams: two (2) **(**20% and 30%)
Final Exam: 40%
Make up Exam 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 and **no more than 48 hours after the** scheduled

Criteria	Grade Weighting
Homework	10%
Midterm Exam-1	20%
Midterm Exam-2	30%
Final Exam	40%
Total	**100%**

Final Exam Date: Wednesday, December 09, 2015, 1:00pm – 3:50pm

Academic Integrity: Students are expected to uphold the highest standards in academic integrity as in their pledge of the UCF Creed: "***I will practice and defend academic and personal honesty***". Anyone caught cheating during any of the tests and exams will be assigned an F-grade.

Financial Aid and Attendance: As of Fall 2014, all faculty members are required to document students' academic activity at the beginning of each course. In order to document that you began this course, please complete the following 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.

Write a short sentence explaining why you have decided to enroll in this course.

Grade Objections:
All objections to grades should be made **in writing within one week** of the work in question.

Class Website:
Materials used for classes will be available on UCF Webcourses for download before each class.

Professionalism and Ethics:
Per university policy and plain classroom etiquette, mobile phones, etc. must be silenced during all classroom lectures, unless you are specifically asked to make use of such devices for certain activities. Academic dishonesty in any form will not be tolerated! If you are uncertain as to what constitutes academic dishonesty, please consult The Golden Rule in the UCF Student Handbook (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.

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 www.sds.sdes.ucf.edu or at (407)823-2371.

Dates:

First Day of Class	Monday, August 24,2015
Last Day to Drop Classes:	Thursday, August 27, 2015
Last Day to Add Classes:	Friday, August 28, 2015 11:59 PM
Withdrawal Deadline	Monday, November 02, 2015 11:59 PM
Classes End	Monday, December 07, 2015
Final Exam:	Wednesday, December 09, 2015 1:00pm – 3:50pm

Topics Covered in OSE 5414 Optoelectronic Devices

Electronic processes in Semiconductors

Quantum mechanics and band theory. Band structure and carrier effective masses. Scattering and carrier mobilities. Semiconductors statistics. Carrier recombination.

Optical properties of semiconductors

Absorption. Relationships between optical constants. Radiative transitions. Nonradiative recombination

Junction theory

P-N junctions. Depletion layer and junction capacitance. Forward and reverse biased processes. Contacts. Heterojunctions.

Light emitting diodes

Electroluminescence. LED structures. Device characteristics including efficiency, spectral response, power output, light-current and current-voltage response and frequency response.

Laser diodes

Waveguide theory. Population inversion, gain and lasing condition in a semiconductor. Laser current threshold and spectral characteristics. Operation of the junction laser diode. Heterojunction lasers. Quantum well lasers. Modulation and frequency response.

Photodetectors

Photoconductors. Junction photodiodes. Avalanche photodiodes. High speed diodes. Metal-Semiconductor-Metal (MSM) diodes. Solar Cells. CCD sensors.

Optoelectronic modulators and switches

Franz-Keldysh effect. Quantum confined Stark effect in quantum well semiconductors. Electro-absorption modulators and electro-refraction devices