

ECE 492-048/ECE 592-095

Semiconductor Optoelectronic Devices

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Objective or Description: This course explores the theory and operational characteristics of semiconductor optoelectronic devices. It broadly covers the fundamentals of the propagation, modulation, generation, and detection of light in semiconductors. Topics include the energy transfer between photons and electrons/holes, light emission and absorption, radiative and non-radiative processes, electrical and optical characteristics, semiconductor materials, heterojunctions, and light extraction and trapping. Specific devices and are discussed include laser diodes, light-emitting diodes, electroabsorption modulators, photodetectors, and solar cells.

Prerequisites: ECE 303 and 404, or equivalent. Programing and plotting using a software package such as Matlab, Python, or Excel is required.

Textbook: Sun Lien Chuang, Physics of Photonic Devices Second Edition, (2009).

- Topics:**
1. Basic semiconductor electronics and quantum mechanics
 2. Semiconductor electronic band structure
 3. Optical processes in semiconductors
 4. Light-emitting diodes
 5. Fundamentals of semiconductor laser diodes
 6. Advanced semiconductor lasers
 7. Electroabsorption modulators
 8. Photodetectors and solar cells

Grading: The course will consist of weekly homework assignments, a midterm exam, and a final exam with the following proportions toward the final grade:

1. Homework assignments – 30 % (11-12 homework sets)
2. Midterm Exam – 30 %
3. Final Exam – 40 %

Graduate students will have extra problems on homework and exams.

Lectures will also include new topical areas not included in the textbook, especially from my research (<http://www.jwierer.com>). Examples include quantum dot active layers, III-nitride LEDs and lasers, and semiconductor materials challenges.

