ELEC 5970/6970 OPTOELECTRONICS Spring 2025

Classroom:	107 Broun Hall	**Class Time:**	TR 11:00 am - 12:15 pm
Instructor:	Zihe Gao	**Email:**	zzg0036@auburn.edu
Office:	422 Broun Hall	**Phone:**	(334) 844-1629

Course Communications:

- Course materials and announcements will be posted on Canvas. Students are advised to visit Canvas regularly.

- If you choose to send an email please use the following format. In the subject line write your full name and course number with the semester (For example: Your Name - ELEC5970 - S2024).

Prerequisite(s): Electromagnetics or wave physics (e.g., ELEC 3320, PHYS 1510, or equivalent)

Office Hours: Tentatively set to Wed 4-5pm. (In addition to the office hours, you can find me after class, or by appointment, or post your questions in the forum provided for this purpose on Canvas.)

Course Objectives: The course is an introduction to the fundamentals of optoelectronic devices and systems. This course provides the background in optics, semiconductor light-emitting and light-receiving devices, and optical communications, imaging and display systems. The course helps students meet the demand of the growing semiconductor optoelectronic industry, and prepares them for advanced study and research in photonic devices and optical systems.

Course Outline:

1. Optics (ray optics, lens systems, wave optics, Fourier optics, holography)

2. Light-matter interaction, compound semiconductors, bandgap engineering

3. Introduction to diodes, light emitting devices, detectors, and modulators

4. Basic optical communications, imaging, and display systems

Grading Policy: ELEC 5970

Homework	30%
Midterm Exam	30%
Final Exam	35%
Class Participation	5%

Grading Policy: ELEC 6970

Homework	20%
Midterm Exam	30%
Final Exam	35%
Final Project	15%

Course Materials and Recommended Text(s):

- Lecture Notes

- Saleh and Teich, *Fundamentals of Photonics, 3rd ed.*, Wiley Interscience, 2019. (Recommended but not required)

Supplementary Text(s):

- S. L. Chuang, *Physics of Photonic Devices, 2nd ed.*, Wiley, 2009.

- A. Yariv and P. Yeh, *Photonics: Optical electronics in Modern Communications, 6th ed.*, Oxford University Press, 2007

- E. Hecht, *Optics, 5th ed.*, Pearson, 2015.

- Coldren, Corzine, and Mashanovitch, *Diode Lasers and Photonic Integrated Circuits, 2nd ed.*, Wiley, 2012.

- Peatross and Ware, *Physics of Light and Optics*, http://optics.byu.edu/textbook.aspx

Required Software/Tool(s): Python. (No prior knowledge required. Initial numerical examples and problems will be mathematically and conceptually simply and will give you a chance to understand the basic operation and functioning of the program.)

Numerical Homework: Numerical homework are to be performed in Python (again, no prior knowledge of Python is needed).
Example numerical homework: Problem 0. Calculate the normal incidence reflection at an air/dielectric interface as a function of wavelength between 400-700 nm. The dielectric's index of refraction can be described, in this range, as $n(\lambda) = 3 + (0.4 - \lambda)/7$, where λ is the wavelength of light, in microns. Your script should plot reflection vs λ and outputs arrays for λ, n, and R.
Problem Name: Reflection
Solution: Reflection_ZiheGao.py (file on Canvas)

Course Project: Each ELEC 6970 student will give an in-class presentation focused on a numerical simulation of a photonic device, system, or a phenomena. The simulation can be done with commercial software (e.g., Lumerical, COMSOL, Zemax) or home-built programs (e.g., Fourier optics, finite-element frequency domain, etc.) Presentations will be 15 minutes long, including 2-3 minutes for questions following the presentation. Presentations will be graded on technical content, oral communication, visual presentation skills, as well as the presenter's ability to answer questions.

Academic Dishonesty: All cases of academic dishonesty will be handled promptly following the University's Student Academic Honesty Code.
(https://www.auburn.edu/academic/provost/academic-honesty/).

Student's with Special Needs: In accordance with the Americans with Disabilities Act, students with bona fide disabilities will be afforded reasonable accommodation. The Office of Accessibility will certify a disability and advise faculty members of reasonable accommodations. If you have a specific disability that qualifies you for academic accommodations, please notify the instructor/professor and provide certification from the Office of Accessibility as early as possible. (The Office of Accessibility is located at 1228 Haley Center, phone: 334-844-2096).

Changes in Course Requirements: Since all classes do not progress at the same rate, I may wish to modify the above requirements or their timing as circumstances dictate. For example, I may wish to change the number and frequency of exams, or the number and sequence of assignments. However, students will be given adequate notification of any changes. Moreover, there may be non-typical classes for which these requirements are not strictly applicable in each instance and may need modification. If such modification is needed, it will be in writing and conform to the spirit of this policy statement.