ELEC 5970/6970 OPTOELECTRONICS Spring 2024

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): ELEC 3320

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 optoelectronics and principles of optoelectronic device operation. This course provides the background in optoelectronics, helps students meet the demand of the growing semiconductor optoelectronic industry, and prepares them for advanced study and research in optoelectronics devices and systems.

Course Outline:

1. Basic concepts of electromagnetic theory, ray optics, diffraction, optical waveguides, and optical processes in semiconductors.
2. Introduction to light emitting devices, detectors, and modulators.
3. Basic optical communications and imaging systems.

Grading Policy: ELEC 6970

Homework	20%
Mid Term Exam	30%
Final Exam	35%
Course Project	15%

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Homework	30%
Mid Term Exam	30%
Final Exam	35%
Class Participation	5%
Course Project	15% (optional, extra credit)

Grade Assignment: 90%-100% A, 80%-89% B, 70%-79% C, 60-69% D, Below 60% F

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.)

Class Policies: Attendance at lectures is strongly recommended. Attendance at tests is MANDATORY. Students are responsible for all materials covered in the class as well as the announcements for homework assignments, assignment due dates and test dates.

Number and Type of Examinations to be Given During the Semester: One midterm examination and one final examination will be given. The midterm and final examination dates will be announced in class, and will cover material discussed in lectures and lecture notes. The instructor has the right to change this policy at any time.

Homework Policy: Homework will be assigned periodically throughout the semester. Homework will typically be assigned on Thursdays and will be due the following Thursday at the beginning of class (submit your homework as a pdf file, uploaded on Canvas). Homework will be checked, but not corrected, by the instructor... solutions will be provided. Characteristics of a complete homework solution include:

- Careful, neat work
- Professional language and style
- Statement of required assumptions
- Detailed exposition of critical steps
- Answers to each part of the problem (**clearly labeled**)

Numerical Homework: Numerical homework are to be performed in Python (again, no prior knowledge of Python is needed). All numerical homework problems should be clearly and concisely annotated. Numerical homework problems are to be turned in electronically on Canvas before class.

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)

Make-up Examination Policy: Make-up exams may only be given in case of extenuating circumstances. Your instructor will make a decision on the make-up examination after verifying the appropriate written documentation. Failure to furnish written, verifiable documentation will result in a grade of zero for the missed examination. The instructor may elect to count the final exam for additional value instead of providing a make-up exam.

Penalty for Late Work: All assignments must be submitted on the due date. Late assignments will not be accepted unless a bona fide emergency has occurred.

Course Project: Each ELEC 6970 student (optionally teaming up with 5970 students) will give an in-class presentation focused on a cutting edge research topic in optoelectronics or a numerical program (developed by the student) used for advanced simulation or calculation of a photonic phenomena, device, or system. 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. ELEC 5970 students may choose to participate in the project and the presentation by forming teams with the 6970 students and obtain extra credits (judged by their levels of contribution). If such teams are formed, each team may include one 6970 student and any number of 5970 students.

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.

CLASS ATTENDANCE (Taken from Dr. T.A. Baginski)

On-time class attendance is important because:

- Your understanding of the material will be greater. You will receive a professionally prepared presentation on the subject, which may include supplementary material. As an emerging professional, you incur professional and ethical responsibilities. Your primary mission at Auburn is to acquire a formal education. To that end, the single most important action you can take is to attend class.
- As a serious conscientious student, you owe a 3-credit course 9 hours of effort per week. (13.5 hours on the summer schedule). The most efficient and constructive use of this time is to spend 33% of it in class.
- You are made aware of any administrative changes relating to the course.
- There is a mutual social responsibility between all class members (students and instructors). Your classmates, and the instructor, need and value your input. People learn from each other. Consider a sports analogy: would the football team have success if players didn't attend practice, or games, or never showed up on time?
- Conversely, your absence creates problems for others. You don't pick up your work, you don't get copies of handouts, you are unaware of course administrative changes, etc. Late arrivals, or early departures, are distractions to the class, and are rude and inconsiderate.
- Your self-esteem will be enhanced. You are doing the right thing. You are behaving responsibly, ethically, and professionally!