UNIVERSITY OF CENTRAL FLORIDA

OSE 6421 - INTEGRATED PHOTONICS

Section: 0001

Optics and Photonics

Course Information

Term: Fall 2024
Class Meeting Days: TR
Class Meeting Time: 13:30 - 14:45
Class Meeting Location: CROL A214
Modality: P
Credit Hours: 3.00

Instructor Information

Sasan Fathpour
Title: Professor
Office Location: A216
Office Hours:
3-4 pm on Thursdays
Email: fathpour@creol.ucf.edu

Teaching Assistants

None.

Course Description

OSE 6421 OPT-OPT 3(3,0)Integrated Photonics: PR: Graduate standing, OSE 6111 or C.I. Reviews working principle, system functionality and design and fabrication issues of semiconductor integrated photonic devices and circuits for optical telecommunication and interconnect applications. Spring.

The course complements the OSE courses on ‘fundamentals of optoelectronic devices’, ‘computational photonics’, and ‘optical communication systems’ to deepen students’ education in photonic engineering. In order to analyze and design integrated photonic devices and circuits, it is necessary to study the components that constitute them, the principles that underlie their operation, and their functional characteristics from the perspective of a device engineer. To this extent, the course will begin with very briefly reviewing optoelectronic device principles as well as optical waveguide design. It will then quickly get into discussions on advanced integrated devices and circuits such as optical switches, optical transceivers, wavelength converters, arrayed waveguide gratings, etc. The course will end with more state-of-the-art topics such as silicon photonics.

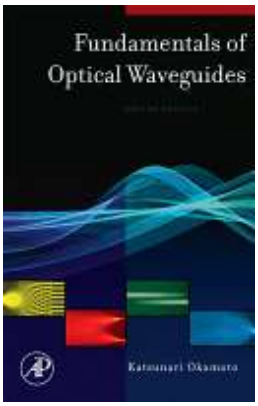
Student Learning Outcomes

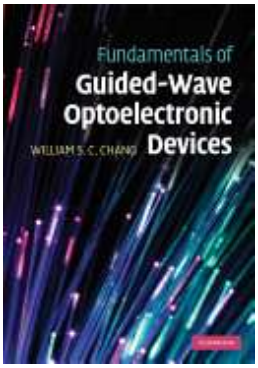
After successful completion of this course, students will be able to:

- The course’s goal is elucidating the key principles underlying the analysis and design of integrated photonic devices and circuits, with an emphasis on the engineering and practical aspects of them. The students should be able to understand, and design integrated photonic devices and circuits at the end of the course. The course also introduces selected advanced research topics currently pursued in the field.

Course Materials and Resources

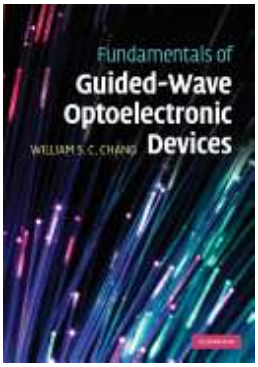
Fundamentals of Optical Waveguides
ISBN: 9780125250962
Authors: Katsunari Okamoto
Publisher: Academic Press
Publication Date: 2006-01-01





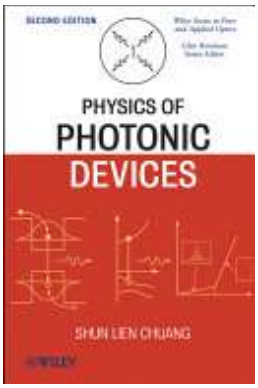
Fundamentals of Guided-Wave Optoelectronic Devices
ISBN: 9780521868235
Authors: William S. C. Chang
Publisher: Cambridge University Press
Publication Date: 2010-01-01

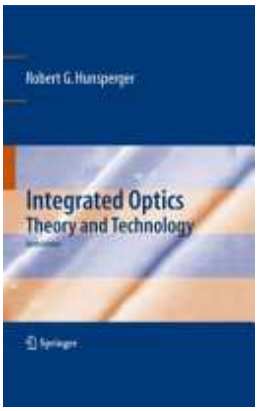
Recommended Course Materials



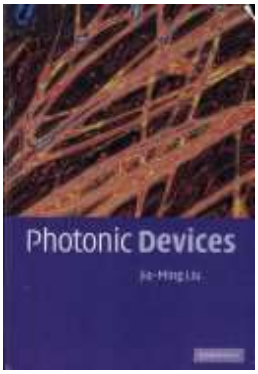
Title: Fundamentals of Guided-Wave Optoelectronic Devices
ISBN: 9780521868235
Authors: William S. C. Chang
Publisher: Cambridge University Press
Publication Date: 2010-01-01

Title: Physics of Photonic Devices
ISBN: 9781118585658
Authors: Shun Lien Chuang
Publisher: John Wiley & Sons
Publication Date: 2012-11-07





Title: Integrated Optics
ISBN: 9780387897752
Authors: Robert G. Hunsperger
Publisher: Springer Science & Business Media
Publication Date: 2009-04-29



Title: Photonic Devices
ISBN: 9781139441148
Authors: Jia-ming Liu
Publisher: Cambridge University Press
Publication Date: 2009-06-11

Course Assessment and Grading Procedure

Homework Assignments: 30%
Midterm Exam: 30% (October 15, 1:30 – 2:45 pm in class)
Final Exam: 40% (UCF calendar: Tuesday, December 3, 2024, 1:00 PM – 3:50 PM)

Assignment Schedule

Due Date	Assignment Name	Assignment Type	Points
	Enrollment Unnamed Quiz	Quiz	0

Grading Scale

Letter Grade	Percentage
A	94-100%
A-	90-93%
B+	87-89%
B	84-86%
B-	80-83%
C+	77-79%
C	74-76%
C-	70-73%
D+	67-69%
D	64-66%
D-	61-63%
F	0-60%

Policies for Course Grade

Missed/Late Assignments: Students can have one late assigment submission (within 72 hours of the original deadline).

Course Accessibility

The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need access to course content due to course design limitations should contact the professor as soon as possible.

Students should also connect with Student Accessibility Services (SAS) (Ferrell Commons 185, sas@ucf.edu, phone 407-823-2371). For students connected with SAS, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential course access and accommodations that might be necessary and reasonable. Determining reasonable access and accommodations requires consideration of the course design, course learning objectives and the individual academic and course barriers experienced by the student. Further conversation with SAS, faculty and the student may be warranted to ensure an accessible course experience.

Academic Integrity

Students should familiarize themselves with UCF's Code of Conduct at Student Conduct and Integrity Office. According to Section 1, "Academic Misconduct," students are prohibited from engaging in:

a. Academic misconduct is defined as any submitted work or behavior that obstructs the instructor of record's ability to accurately assess the student's understanding or completion of the course materials or degree requirements (e.g., assignment, quiz, and/or exam). Examples of academic misconduct include but are not limited to: plagiarism, unauthorized assistance to complete an academic exercise; unauthorized communication with others during an examination, course assignment, or project; falsifying or misrepresenting academic work; providing misleading information to create a personal advantage to complete course/degree requirements; or multiple submission(s) of academic work without permission of the instructor of record.
b. Any student who knowingly helps another violate academic behavior standards is also in violation of the standards.
c. Commercial Use of Academic Material. Selling of course material to another person and/or uploading course material to a third-party vendor without authorization or without the express written permission of the University and the instructor of record. Course materials include but are not limited to class notes, the instructor of record's slide deck, tests, quizzes, labs, instruction sheets, homework, study guides, and handouts.
d. Soliciting assistance with academic coursework and/or degree requirements. The solicitation of assistance with an assignment, lab, quiz, test, paper, etc., without

authorization of the instructor of record or designee is prohibited. This includes but is not limited to asking for answers to a quiz, trading answers, or offering to pay another to complete an assignment. It is considered Academic Misconduct to solicit assistance with academic coursework and/or degree requirements, even if the solicitation did not yield actual assistance (for example, if there was no response to the solicitation).

Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should also familiarize themselves with the procedures for academic misconduct in UCF's student handbook, *The Golden Rule*. UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and respond to academic misconduct when necessary. Penalties for violating rules, policies, and instructions within this course can range from a zero on the exercise to an "F" letter grade in the course. In addition, an Academic Misconduct report could be filed with the Office of Student Conduct and Academic Integrity, which could lead to disciplinary warning, disciplinary probation, or deferred suspension or separation from the University through suspension, dismissal, or expulsion with the addition of a "Z" designation on one's transcript.

Being found in violation of academic conduct standards could result in a student having to disclose such behavior on a graduate school application, being removed from a leadership position within a student organization, the recipient of scholarships, participation in University activities such as study abroad, internships, etc.

Let's avoid all of this by demonstrating values of honesty, trust, and integrity. No grade is worth compromising your integrity and moving your moral compass. Stay true to doing the right thing: take the zero, not a shortcut.

Reporting an Incident or Issue

If you believe you have experienced abusive or discriminatory behavior by any faculty of staff member, contact the Office of Institutional Equity online or at 407-823-1336. You can also choose to report using the UCF Integrity Line and can report anonymously or as yourself at 1-855-877-6049 or using the online form. UCF cares about you and takes every report seriously. For more information see the Reporting an Incident or Issue Webpage.

Title IX

Title IX prohibits sex discrimination, including sexual misconduct, sexual violence, sexual harassment, and retaliation. If you or someone you know has been harassed or assaulted, you can find resources available to support the victim, including confidential resources and information concerning reporting options at Let's Be Clear and UCF Cares.

For more information on diversity and inclusion, Title IX, accessibility, or UCF's complaint processes contact:

- Title IX – OIE – Office of Institutional Equity & askanadvocate@ucf.edu
- Disability Accommodation – Student Accessibility Services – Student Accessibility Services & sas@ucf.edu
- Access and Community Engagement (including the Ginsberg Center for Inclusion and Community Engagement, Military and Veteran Student Success, and HSI Initiatives)
- UCF Compliance and Ethics Office – Compliance, Ethics, and Risk Office & complianceandethics@ucf.edu
- The Ombuds Office is a safe place to discuss concerns.

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Deployed Active-Duty Military Students

Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the

semester begins and/or after they receive notification of deployment to make related arrangements.

Campus Safety

At UCF Public Safety and Police, safety is the top priority. Emergencies on campus are rare, but if one should arise, it's important to be familiar with some basic safety and security concepts.

- In an emergency, always dial 911.
- Every UCF classroom has an **Emergency Procedure Guide** posted on a wall near the door, which will show you how to respond to a variety of situations. This guide can also be found online here.
- In the event of an active threat, remember **AVOID, DENY, DEFEND**. Choose the best course of action and act immediately. Watch the video here to learn more.
    - **AVOID**. Pay attention to your surroundings and have an exit plan. Get as much distance and as many barriers between you and the threat as quickly as possible.
    - **DENY.** When avoiding is difficult or impossible, deny the threat access to you and your space. Lockdown by creating barriers, turning the lights off and remaining quiet and out of sight. Make sure your cell phone is silenced, but do not turn it off.
    - **DEFEND.** When you are unable to put distance between yourself and the threat, be prepared to protect yourself. Commit to your actions, be aggressive and do not fight fairly. Do whatever it takes to survive.
- For emergencies on campus, UCF will utilize the UCF Alert system. All UCF students, faculty and staff are automatically enrolled to receive these email and text alerts, however, it's a good idea to frequently ensure your contact information is up to date.

Financial Aid Accountability

All instructors/faculty are required to document students' academic activity at the beginning of each course. In order to document that you began this course, please

complete this activity by the end of the first week of classes or as soon as possible after adding the course. Failure to do so may result in a delay in the disbursement of your financial aid.

Class Schedule

1	Introduction: Why Integrated Photonics?
2	Slab (1-D) waveguides
3	Analytical solutions to 2-D waveguides
4	Numerical analysis of 2-D and 3-D waveguides
5	Coupled-mode theory (codirectional)
6	Coupled-mode theory (contradirecional)
7	Super-mode analysis
8	Optical mode converters, prism and grating couplers
9	Energy loss in optical waveguides
10	Wavelength-division multiplexing components
11	Multimode interferometers
12	Microring resonators
13	Bragg grating waveguides
14	III-V optoelectronic integrated circuits
15	Silicon photonics
16	