UNIVERSITY OF CENTRAL FLORIDA

OSE 6335 - NONLINEAR GUIDED WAVE OPTICS

Section: 0001

Optics and Photonics

Course Information

Term: Fall 2025
Class Meeting Days: TR
Class Meeting Time: 03:00PM - 04:15PM
Class Meeting Location: CROL A214
Modality: P
Credit Hours: 3.00

Combined Course Details

This syllabus applies to OSE 6335 0001, OSE 6335 00V2.

Instructor Information

Name: Andrea Blanco Redondo
Office Location: CREOL 210
Office Hours
Tu and Th 11am-12pm
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Course Description

OSE 6335 OPT-OPT 3(3,0)Nonlinear Guided Wave Optics: PR: Graduate standing and OSE 6334C or C.I. The physics and applications of nonlinear optical interactions in fibers and planar waveguides is discussed, including parametric processes, all-optical effects and solitons. Even Fall.

This course aims to give students a comprehensive understanding of pulse propagation through optical waveguides, a crucial matter for most aspects of modern optics and photonics, including optical communications, ultrafast lasers, and quantum optics. It focuses on media with dominant third-order nonlinear () effects, such as silica optical fibers and silicon photonic waveguides, due to their practical importance.

We will begin by a general introduction of nonlinear optics, followed by reviewing the fundamentals of optical fibers and integrated optical waveguides, introducing the effects of attenuation, dispersion, and nonlinearity. Next, we will obtain the basic equation that governs pulse propagation in optical waveguides and will work together on building a code to solve this equation. This code will be used by the students throughout the rest of the course as a tool to understand the effects highlighted above and their fascinating interplay.

Armed with this powerful tool we will delve deeper in the concepts of chromatic dispersion –different frequencies travelling at different speeds – and nonlinear refraction – the intensity dependence of the refractive index. Building on these foundations we will then cover many important phenomena such as dispersive pulse broadening, self-phase modulation, optical solitons, cross-phase modulation, four-wave mixing, and supercontinuum generation.

Subsequently, we will discuss nonlinear effects that are especially important in optical fibers: stimulated Raman and Brillouin scattering. This class of nonlinear effects result from stimulated inelastic scattering, in other words, from the optical field transferring part of its energy to the medium.

Analogously, semiconductor photonic waveguides showcase their own specific nonlinearities, such as two-photon absorption and free-carrier nonlinearities, which we will also discuss in this course.

After covering the fundamentals, we will examine some specific applications of the phenomena covered above, such as ultrafast soliton lasers, the generation of entangled photons through four-wave mixing, and supercontinuum sources for spectroscopy and sensing.

Towards the end of the course the students will work on a research topic of their choice, by choosing a paper, reproducing its results using simulations, and, perhaps, from there finding new unexplored research directions.

Student Learning Outcomes

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

- Simulate pulse propagation in optical waveguides (optical fibers and integrated photonic waveguides) in realistic environments, such as communication links, laser cavities, and sources of quantum light.
- Understand the origin and the consequences of the frequency dependence of the refractive index – dispersion.
- Understand the origin and the consequences of the intensity dependence of the refractive index – nonlinear refraction.
- Explain the fascinating and pervasive phenomenon of optical solitons, originating from the balance of dispersion and nonlinearity.
- Explain nonlinear phenomena involving several waves such as four-wave mixing and cross-phase modulation.
- Comprehend the importance of nonlinear optics and the crucial role it plays in real life applications.

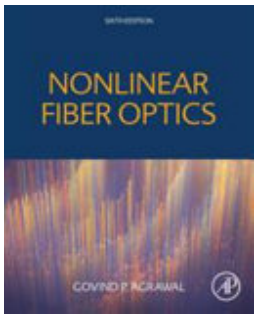
Required Course Materials and Resources

Lecture notes provided by the instructure
Authors: Andrea Blanco-Redondo

Recommended Course Materials

Title: Lecture Notes
Authors: Andrea Blanco-Redondo

Title: Nonlinear Fiber Optics



ISBN: 9780128170427
Authors: Govind P. Agrawal
Publisher: Academic Press
Publication Date: 2019-08-15

Course Assessment and Grading Procedure

The course will be graded based on homework assignments and a final presentation.

Grading Scale

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

Makeup Work Policy

Extenuating circumstances may be considered case-by-case.

Missed/Late Assignments

If an emergency arises and a student cannot submit assigned work by the due date, the student must notify the instructor as soon as possible. Extenuating circumstances may be considered case-by-case.

Attendance

Regular class attendance is necessary for students to fully grasp the course concepts.

If you miss a class session, it will be your responsibility to find out the materials that were covered.

Disability Access & Accommodations

The University of Central Florida is committed to providing equal access to all students with disabilities (ADHD, learning disabilities, Autism, chronic medical conditions, physical disabilities, etc.). To receive consideration for reasonable disability-related course accommodations, disabled students must contact Student Accessibility Services (SAS) and complete the steps required for SAS to review accommodation requests. More information can be found on the UCF Student Accessibility Services website under the Start Here tab or by contacting SAS directly (Ferrell Commons 185; sas@ucf.edu; Phone - 407-823-2371).

Approved accommodations are shared with course instructors via the SAS Course Accessibility Letter. Implementing certain accommodations may require discussion about specific considerations of the course design, course learning objectives, and the individual academic and course challenges experienced by the student. While students with disabilities or chronic health needs are also encouraged to discuss any course concerns with professors in addition to contacting SAS, professors are not required to facilitate disability-related adjustments to the course unless the professor has received a Course Accessibility Letter from SAS that outlines approved accommodations.

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:

1. 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 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.
2. Any student who knowingly helps another violate academic behavior standards is also in violation of the standards.
3. 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 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.
4. 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.

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 access and community engagement, Title IX, accessibility, or UCF's complaint processes contact:

- Title IX – ONAC – Office of Nondiscrimination & Accommodations Compliance & 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.

Reporting an Incident or Issue

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

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 arrangements.

Campus Safety

At UCF's 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 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

Course Schedule

Week	Topic
1	
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Week	Topic
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