

**OSE 3052: Foundations of Photonics****Credit Hours: 3****Term: Fall 2022****Syllabus**

Class Time:	Mondays and Wednesday, 3:00pm – 4:15pm, August 19 th to November 30 th
Recitation Time	Wednesdays, 2:00pm – 2:50pm, August 19 th to November 30 th
Location:	CREOL 102
Prerequisites:	Grades of "C" (2.0) or better in PHY 2049C and MAP 2302.
Course Description:	Introduction to wave and photon models of light. Polarization and coherence. Interference and diffraction of light. Interferometers and spectrometers,
Instructor:	Patrick LiKamWa
Email/Contact Info:	patrick@creol.ucf.edu / 407-823-6816
Office Hours and Location:	Tuesdays and Thursdays, 8:00am – 11:00am, CREOL 209
Course Modality:	P (In-Person)
GTAs:	None
Class Website/ Webcourse	https://webcourses.ucf.edu/courses/1416827

Course Materials

Course Textbook:

Optics, 5th ed., Eugene Hecht, Pearson, 2016.

Reference (Optional) Books:

Introduction to Optics, 3rd ed., F. L. Pedrotti, L.S. Pedrotti and L. M. Pedrotti, Prentice-Hall, 2009

Schaum's Outline of Theory and Problems of Optics, Eugene Hecht, McGraw Hill, 1975.

Fundamentals of Photonics, 2nd edition B. Saleh and M. Teich, Wiley, 2007n.

Course Grading and Requirements for Success:

- **The student is expected to review the textbook, notes, and other materials before class.**
- **You are required to attend class as well as the mandatory discussion sessions**

Homework: 10%**Mid-Term Exams:** 40%**Quizzes:** 20%**Participation:** 30%**Final Exam:** (Wednesday, December 7, 2022 1:00 PM – 3:50 PM)**Make Up Policy:** If an emergency arises and a student cannot submit assigned work on or before the scheduled due date or cannot take an exam on the scheduled date, the student **must** give notification to the instructor **no less than 24 hours before** the scheduled date and **no more than 48 hours after the** scheduled date.

Attendance Policy: Attendance is a required component of this course. We will use “UCF Here” to register attendance. Please be ready by installing the app. If your attendance was not registered for whatever reason, just send me an email to let me know that you were in class. You need to do so as soon as you have realized the error.

An absence can be excused, if you inform the instructor of the valid reason, either before the event or as soon as you come back to class.

Criteria	Grade Weighting
Homework	10%
Quizzes	20%
Participation (Attendance)	5%
Midterm Exams	40%
Final Exam	30%
Total	105%

Assignment Submission

Homework assignments:

You will download all your homework from Webcourses.

You will do your homework neatly and systematically showing all the steps using pen (or pencil) on white paper (Make sure that you write legibly). You will either scan or take photographs of all the sheets of paper containing your work and combine all the jpg files into a single pdf file and submit them on Webcourses by the deadline. If you are not able to combine into a single pdf file, it is acceptable for you to submit all the jpg files separately.

Your graded homework will be returned to you via Webcourses.

Quizzes:

You will use Lockdown Browser to access the quizzes and you will answer questions directly in Webcourses.

Exams:

All mid-term and final exams will be in class and you will turn in your work at the end of the exam. Your graded tests will be returned back during class.

Financial Aid and Attendance: To document that you began this course, please complete the **Academic Activity** assignment posted on Webcourses by the end of the first week of classes, or as soon as possible after adding the course, but no later than **August 26th**. Failure to do so will result in a delay in the disbursement of your financial aid.

Grading Scale (%)	Rubric Description
100 ≥ A > 93 ≥ A ⁻ > 90	Excellent, has a strong understanding of all concepts and is able to apply the concepts in all and novel situations. Has full mastery of the content of the course.
90 ≥ B ⁺ > 87 ≥ B > 83 ≥ B ⁻	Good, has a strong understanding of most or all of the concepts and is able to apply them to stated and defined situations.
80 ≥ C ⁺ > 77 ≥ C > 73 ≥ C ⁻	Average, has a basic understanding of the major concepts of the course and is able to apply to basic situations.
70 ≥ D ⁺ > 67 ≥ D > 63 ≥ D ⁻	Below average, has a basic understanding of only the simple concepts and is able to apply to only a limited number of the most basic situations.
60 ≥ F	Demonstrates little to no understanding of the course content.

Grade Objections:

All objections to grades should be made **in writing within one week** of the work in question. Objections made after this period has elapsed will **not** be considered – NO EXCEPTIONS.

Deadlines, Holidays, and Significant Semester Events:

First Day of Class	August 22, 2022
Last Day to Add/Drop Classes	August 26, 2022
Withdrawal Deadline	October 28, 2022
Last Day of Class	November 30, 2022
Final Exam	December 7, 2022

Student Learning Outcomes and Measures

Outcome	Measure	Course
1 Graduates have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	1.1 A passing student must be able to formulate and solve a complex or multistep problem based on relevant parameters.	OSE3052 Foundations of Photonics
1 Graduates have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	1.2 A passing student must be able to identify a photonics engineering problem out of a complex, context-rich statement or scenario.	OSE3052 Foundations of Photonics

Policy Statements

Academic Integrity

Students should familiarize themselves with UCF's Rules of Conduct at <https://scai.sdes.ucf.edu/student-rules-of-conduct/>. According to Section 1, "Academic Misconduct," students are prohibited from engaging in

1. Unauthorized assistance: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The unauthorized possession of examination or course-related material also constitutes cheating.
2. Communication to another through written, visual, electronic, or oral means: The presentation of material which has not been studied or learned, but rather was obtained through someone else's efforts and used as part of an examination, course assignment, or project.
3. Commercial Use of Academic Material: Selling of course material to another person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor's PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.
4. Falsifying or misrepresenting the student's own academic work.
5. Plagiarism: Using or appropriating another's work without any indication of the source, thereby attempting to convey the impression that such work is the student's own.
6. Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.
7. Helping another violate academic behavior standards.
8. Soliciting assistance with academic coursework and/or degree requirements.

Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should familiarize themselves with the procedures for academic misconduct in UCF's student handbook, *The Golden Rule* <<https://goldenrule.sdes.ucf.edu/>>. 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, 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.

Unauthorized Use of Websites and Internet Resources

There are many websites claiming to offer study aids to students, but in using such websites, students could find themselves in violation of academic conduct guidelines. These websites include (but are not limited to) Quizlet, Course Hero, Chegg Study, and Clutch Prep. UCF does not endorse the use of these products in an unethical manner, which could lead to a violation of our University's Rules of Conduct.

They encourage students to upload course materials, such as test questions, individual assignments, and examples of graded material. Such materials are the intellectual property of instructors, the university,

or publishers and may not be distributed without prior authorization. Students who engage in such activity could be found in violation of academic conduct standards and could face course and/or University penalties. Please let me know if you are uncertain about the use of a website so I can determine its legitimacy.

Unauthorized Distribution of Class Notes

Third parties may attempt to connect with you to sell your notes and other course information from this class. Distributing course materials to a third party without the instructor's authorization is a violation of our University's Rules of Conduct. Please be aware that such class materials that may have already been given to such third parties may contain errors, which could affect your performance or grade.

Recommendations for success in this course include coming to class on a routine basis, visiting me during my office hours, connecting with the Teaching Assistant (TA), and making use of the Student Academic Resource Center (SARC), the University Writing Center (UWC), the Math Lab, etc. If a third party should contact you regarding such an offer, I would appreciate your bringing this to my attention. We all play a part in creating a course climate of integrity.

In-Class Recording

Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach enrolled students about a particular subject.

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, private conversations between students in the class or between a student and the faculty member, and invited guest speakers is prohibited.

Recordings may not be used as a substitute for class participation and class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct as described in the Golden Rule.

Course Accessibility Statement

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) <http://sas.sdes.ucf.edu/> (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.

Deployed Active Duty Military Students

If you are a deployed active duty military student and feel that you may need a special accommodation due to that unique status, please contact your instructor to discuss your circumstances.

Campus Safety Statement

Emergencies on campus are rare, but if one should arise during class, everyone needs to work together. Students should be aware of their surroundings and familiar with some basic safety and security concepts.

- In case of an emergency, dial 911 for assistance.
- Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide's physical location and review the online version at <https://centralflorida-prod.modolabs.net/student/safety/index>.
- Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency.
- If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see <https://ehs.ucf.edu/automated-external-defibrillator-aed-locations>.
- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to <https://my.ucf.edu> and logging in. Click on "Student Self Service" located on the left side of the screen in the toolbar, scroll down to the blue "Personal Information" heading on the Student Center screen, click on "UCF Alert", fill out the information, including e-mail address, cell phone number, and cell phone provider, click "Apply" to save the changes, and then click "OK."
- Students with special needs related to emergency situations should speak with their instructors outside of class.
- To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video <https://youtu.be/NIKYajEx4pk>.

Detailed Course Outline

1	Introduction and Course Overview		General Memo - High level talk about how Photonics is everywhere around us
2	Wave Motion	Ch-2	Basic harmonic waves - The differential wave equation - Simple Harmonic Waves - Phase and Phase Velocity - Superposition Principle - The Complex Representation - Phasors and the Addition of Waves - Plane waves -The 3-D Differential Wave Equation - Spherical Waves
3	Photons and Light	Ch-3	Photons as a wave packet - The Wave-Particle Duality - DeBroglie's Principle - The energy of the photon through Einstein relation $E = hf$ - Concept of photon flux and optical power - How for small optical powers the large number of photon/s leads to continuous waves - Single and few photons concepts in imaging - Initial concepts of discrete atomic energy for photon emission.
4	The Superposition of Waves	Ch-7	Addition of coherent waves - Algebraic, Complex and Phasor Additions - Superposition of Waves with different frequencies - Group Velocity and Dispersion - Fourier Series
5	Polarization	Ch-8	Linear Polarization - Malus Law - Polarization by Reflection (Brewster Law)
6	Interference	Ch-9	Temporal and Spatial Coherence - Fresnel-Arago Laws - Young's Experiment - Fresnel's Double Mirror and Lloyd's Mirror - Thin Film Interference - Fizeau Interferometer - Michelson Interferometer - Mach-Zehnder Interferometer - Sagnac Interferometer - Fabry-Perot Interferometer - Single Layer Anti-reflection Coating
7	Diffraction	Ch-10	Fraunhofer vs Fresnel Diffraction - The Single Slit - The Double Slit - Diffraction by Many Slits - Rectangular Aperture - Circular Aperture - Airy Disk - Diffraction Grating - Spectral Resolving Power

Note: The dates of the topics will be posted on Webcourses and are subject to change depending upon how things progress during the course of the semester