

## COURSE SYLLABUS

### OSE 3052 FOUNDATIONS OF PHOTONICS, SPRING 2022

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Instructor: Dr. Rodrigo Amezcua  
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Term: Spring 2022  
Class Days: Monday and Wednesdays  
Class Time: 9:00 - 10:15 AM  
Class Location: CREOL 102

Office Hours: Thursday: 1:00 PM – 2:00 PM (before discussion).  
I will be happy to discuss the course material with you anytime by appointment.

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#### I. University Course Catalog Description

Introduction to wave and photon models of light. Interference and diffraction of light. Polarization. LEDs and Lasers as generators of photons. Detectors of photons.

#### II. Course Overview

##### *Introduction:*

Some of the main growth areas in the “high-tech” sectors are centered on the branch of optics known as “Photonics”, examples are; displays, data storage, telecommunication systems. This is not a temporary phenomenon. Continued growth of optics and photonics based industries means that there will be a growing and permanent need for engineers and scientists with some training in optics. Other areas of optics, such as bio-photonics, laser machining, laser marking, infrared imaging, etc. are growing strongly also. These topics are covered in the other courses in the Photonic Science and Engineering degree program. This course provides students with the strong foundation in optics that will be needed for the subsequent courses. We will frequently make reference to applications as we go.

##### *Content:*

This course introduces the basic descriptions of light as waves (physical optics), and photons. Interference of optical waves is described along with interferometers and their applications to optical metrology and sensing. Fourier series for the analysis of waves. Diffraction of optical waves propagating through apertures is examined and the effects on the resolution of imaging systems and the spreading and focusing of optical beams are covered. Diffraction gratings and grating spectrometers. Introduction to Fourier analysis for treating diffraction. Brief introduction to polarization and polarization devices. Regarding light as photons, a brief introduction to absorption, emission, and luminescence phenomena is followed by a brief description of photonic devices such as light emitting diodes, lasers and optical detectors.

The more advanced electromagnetic properties of light are mostly postponed to the next course in the sequence: OSE 3053 Electromagnetic Waves for Photonics.

#### III. Course Learning Objectives

Upon completion of this course, students should understand the basic principles of modern physical optics and photonics. They should be able to read the specifications of commercial optical instruments such as a scanner for a laser printer, or a spectrometer, and determine how these specifications impact the intended application. They should also be able to solve analysis and design problems for basic optical systems such as the following examples:

- Determine the changes in the Young’s double-slit interference pattern that result from bringing the slits closer by some factor.
- Determine the changes in the Michelson interferogram that result from moving one of the mirrors or inserting a thin glass slab in one of the arms.

**IV. Course Prerequisites**

MAP 2302 Differential Equations.

**V. Credits**

3

**VI. 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, 2007

**VII. Course Requirements**

- The student is expected to review the textbook and other materials before class. Materials used for class will be available on UCF Webcourses
- Occasionally you may be required to take a **graded** short quiz during class
- You are required to attend class
- Internet access, browser and e-mail

**VIII. Course Grading**

<b>Grading Scale (%)</b>	<b>Rubric Description</b>
$100 \geq A > 93 \geq A^- > 90$	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.
$90 \geq B^+ > 87 \geq B > 83 \geq B^-$	Good, has a strong understanding of most or all of the concepts and is able to apply them to stated and defined situations.
$80 \geq C^+ > 77 \geq C > 73 \geq C^-$	Average, has a basic understanding of the major concepts of the course and is able to apply to basic situations.
$70 \geq D^+ > 67 \geq D > 63 \geq D^-$	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.
$60 \geq F$	Demonstrates little to no understanding of the course content.

<b>Course Item</b>	<b>Percent of Final Grade</b>
Homework	5%
Two mid-term exams (20% each)	40%
Quizzes	25%
Final exam	30%
	100%

**IX. Grading 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.

**X. Professionalism and Ethics**

Academic dishonesty in any form will not be tolerated. If you are uncertain as to what constitutes academic dishonesty, please consult The Golden Rule, the University of Central Florida's Student Handbook (<http://www.goldenrule.sdes.ucf.edu/>) for further details. As in all University courses, The Golden Rule Rules of Conduct will be applied. Violations of these rules will result in a record of the infraction being placed in your file and the student receiving a zero on the work in question AT A MINIMUM. At the instructor's discretion, you may also receive a failing grade for the course. Confirmation of such incidents can also result in expulsion from the University.

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**XI. Students with Special Testing/Learning Needs**

Students with special needs and require special accommodations must be registered with UCF Student Accessibility Services prior to receiving those accommodations. Students must have documented disabilities requiring the special accommodations and must meet with the instructor to discuss the special needs as early as possible in the first week of classes. UCF Student Accessibility Services can be contacted at <http://www.sas.sdes.ucf.edu/>, or at (407) 823-2371.

**XII. Excusal from Course Assignments and Course Examinations**

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.

**XIII. Class Attendance and Participation**

- Regular class attendance is mandatory.
- Please be on time to class.
- Come to class prepared.

*Note: The instructor reserves the right to modify the information contained in this document at his discretion.*

**COURSE SCHEDULE**

	Topic
1	Instructor Introduction; Course Overview (ALL)
2	Wave Motion / Fourier Series
3	Photons and Light
4	The Superposition of Waves
5	Polarization
6	Interference
7	Diffraction / Fourier Analysis
8	Lasers and LEDs
9	Photodetectors

*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*