UNIVERSITY OF CENTRAL FLORIDA

OSE 3043 - ANALYTICAL METHODS OF OPTICS

Section: 0001

Optics and Photonics

Course Information

Term: Fall 2025
Class Meeting Days: TR
Class Meeting Time: 04:30PM - 05:45PM
Class Meeting Location: CROL A214
Modality: P
Credit Hours: 3.00

Instructor Information

Name: Olivier Spitz
Office Location: CREOL building, room 222
Office Hours
Wed 3:00pm-4:00pm (or any other time by request)
Email: Olivier.Spitz@ucf.edu

Office Hours

Wed 3:00pm-4:00pm (or any other time by request)

Course Description

OSE 3043 OPTIC-OPTICS 3(3,0)Analytical Methods for Optics: PR: PR: MAC 2313. Applications-oriented course on analytical concepts prevalent in optics and engineering

integrating Matlab as a computational support tool. Fall

Analytical and Coding Methods of Optics will expose the students to common analytical concepts used extensively in optics, physics, and other engineering disciplines. With a focus on applications, this class is designed to teach the students these concepts through relevant optical and engineering examples.

The students, throughout the entirety of this course, will gain an intuitive understanding of computer coding and MATLAB specifically. This analytical methods class will cover linear algebra (matrix and vector manipulations, solutions of linear systems, eigenvalues and eigenvectors, geometric transformations), Fourier transform, and vector calculus.

Topics covered:

- Introduction to Matlab
    - Variable definitions, building a vector, building a matrix
    - Functions, operations, loops
    - Plotting tools
- Linear Systems
    - Matrix Algebra
        - Matrix Manipulation
        - Systems of linear equations
        - Determinants
        - Diagonalization
- Eigenvalues and Eigenvectors
- Coordinate transformations
- Uncertainties
- Fourier Analysis
    - Fourier Series
    - Fourier Integral

    - Fourier Transforms

Student Learning Outcomes

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

- tackle advanced concepts in matrix and vector problems that arise throughout the optics and engineering curriculum.
- use Matlab, and more generally vectorized code, as an effective tool for problem solving, data analysis and visualization

Required Course Materials and Resources

Introduction to Computational Engineering using Matlab
ISBN: 978-1-003-27143-7 (ebk)
Authors: Timothy Bowers
Publisher: CRC Press
Publication Date: 2023
Edition: First

Recommended Course Materials

Title: Mathematical Methods for Optical Physics and Engineering
ISBN: 978-0-521-51610-5
Authors: Greg J. Gbur
Publisher: Cambridge University Press
Publication Date: 2011
Edition: First

Title: Mathematical Methods for Physicists
ISBN: 0-12-059876-0
Authors: George B. Arfken & Hans J. Weber
Publisher: Elsevier Academic Press

Publication Date: 2005
Edition: Sixth

Title: Advanced Engineering Mathematics
ISBN: 978-0-470-45836-5
Authors: Erwin Kreyszig
Publisher: John Wiley & Sons
Publication Date: 2011
Edition: Tenth

Title: Matlab for Engineers
ISBN: 978-1-292-23120-4
Authors: Holly Moore
Publisher: Pearson
Publication Date: 2019
Edition: Fifth

Title: Matlab: A practical Introduction to programming and Problem Solving
ISBN: 978-0-323-91750-6
Authors: Stormy Attaway
Publisher: Elsevier
Publication Date: 2023
Edition: Sixth

Course Assessment and Grading Procedure

Assessment	Grade Weighting
Quiz (academic engagement)	1%
Homework (6 assignments)	60% (10% per assignement)
Participation	9%
Midterm Exam	15%
Final Exam	15%
Total	100%

Assignment Schedule

Due Date	Assignment Name	Assignment Type	Points
8/22/25	Academic Engagement	Quiz	1%
9/12/25	Homework 1	Homework	10%
9/26/25	Homework 2	Homework	10%
10/10/25	Homework 3	Homework	10%
10/24/25	Homework 4	Homework	10%
11/7/25	Homework 5	Homework	10%
11/21/25	Homework 6	Homework	10%
	Midterm Exam	Midterm Exam	15%
	Final Exam	Final Exam	15%
8/22/25	First Week Quiz	Quiz	10
9/12/25	Homework #1	Assignment	100
9/26/25	Homework #2	Assignment	100
10/10/25	Homework #3	Assignment	100
10/24/25	Homework #4	Assignment	100

Grading Scale

Grading Scale

Letter Grade	Percentage
A	94-100%
A-	90-93%
B+	87-89%

Letter Grade	Percentage
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

Students may have to miss a class due to extenuating circumstances, but they have a responsibility to initiate the request for makeup work. All available factors will be considered when determining arrangements and timing for makeup work that has an impact on the course grade. If a student has missed graded assignments of the course that cannot be made up in exactly the same manner, the instructor may substitute an equitable type of activity or assignment in order to assess the missed component.

Missed/Late Assignments

Homework turned in late will be assessed a penalty: 10% will be deduced for each day late and will not be accepted if overdue by more than four days.

Attendance

Students are expected to attend all meetings of their courses. Class attendance, including participation in class activities and assessments, is a critical component of learning. Students

are provided with opportunities to demonstrate their learning and are assumed to have purposefully enrolled in their course with the intent to engage in all class activities and assessments. Students must be on time for class. If the student misses a class, it is the student's responsibility to find out the materials covered.

Homework will be submitted online. Homework is due one week after being assigned.

Homework Policy: The following guidelines are intended to ensure everyone is clear and comfortable regarding what is expected of them for coursework in this class. You can talk to anyone you wish and read anything you wish. I encourage you to discuss the course material and the homework problems with your classmates. However, before you discuss a homework problem with a classmate or look for related information in some other reference, you must first make a solid effort at it on your own. After you discuss a homework problem with a classmate or read related information in some other reference, I expect you to write up the solution on your own, starting from something close to a blank sheet of paper and relevant references like class notes and books.

Participation: Students should participate by asking questions, contributing to discussions, and by answering questions in class.

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	Matlab environment, scripts and built-in functions/Loops and vectorized code
2	Vectors, Matrices and Polarization of Light

Week	Topic
3	System of Equations, Determinants and Inverses
4	Unitary, Normal and Hermitian Matrices/Eigenvalues and Eigenvectors
5	Symbolic MATH toolbox
6	Systems of Linear Ordinary Differential Equations (ODE)/Gram-Schmidt orthonormalization
7	Plotting Tools with Matlab
8	Propagation of TE Modes in a Symmetric Planar Waveguide
9	Fourier Series/Uncertainties in Physical Measurements
10	Mathematics for Fourier Transform
11	Application of Fourier Transform to Electrical Signal Analysis
12	Fourier Optics and Spatial Filtering
13	Discrete Fourier Transform
14	Fast Fourier Transform
15	
16	