



## OSE 3043

### Analytical Methods for Optics

College of Optics and Photonics, University of Central Florida

## COURSE SYLLABUS

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Instructor:	Ryan Gelfand	Term:	Spring 2020
Office:	CREOL A213	Class Meeting Days:	TuTh
Phone:	407-823-1385	Class Meeting Hours:	6:30pm – 7:45pm
E-Mail:	ryan5@creol.ucf.edu	Class Location:	CREOL 102
Website:		Office Hours:	MW 3 – 5 pm

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### I. University Course Catalog Description

Applications-oriented course on analytical concepts prevalent in optics and engineering focusing on the math required for later coursework.

### II. Course Overview

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 homework will be problems mostly from the text book and some extra problems assigned in class. It is important to have a fundamental understanding of the mathematical concepts required in upper level coursework and this class will lay the ground work for extensive knowledge in these areas. We will cover matrix and vector manipulations, solutions of linear systems, eigenvalues and eigenvectors, geometric transformations, and complex analysis.

### III. Course Objectives and Outcomes

At the end of this class the students will be able to tackle advanced concepts in matrix and vector problems that arise throughout the optics and engineering curriculum. They will be beginner users of Matlab and other similar computer coding techniques and be able to tackle advanced mathematics problems; they will be able to apply techniques that are more advanced if and when needed. The students will be able to transform from one bases to another and more importantly why the transformations are important and when to use them and the right ones to use for a specific problem. This class will help with the reinforcement of Analytical concepts that any optical scientist or general engineer should know.

### IV. Course Prerequisites

This class will require the students to have completed Calculus I, II, and III (MAC 2311C, MAC 2312, and MAC 2313) and Differential Equations (MAP 2302).

### V. Course Credits

3 (3,0)

### VI. Required Texts and Materials

Advanced Engineering Mathematics 10<sup>th</sup> edition  
By Erwin Kreyszig

## VII. Recommended Texts and Materials

Matlab for Engineers 4<sup>th</sup> edition

By Holly Moore

Matlab: A Practical Introduction to Programming and Problem Solving 4<sup>th</sup> edition

By Stormy Attaway

## VIII. Topics Covered

- Linear Systems
  - Matrix Algebra
    - Matrix Manipulation
    - Systems of linear equations
    - Determinants
    - Diagonalization
  - Eigenvalues and Eigenvectors
  - Coordinate transformations
- Vector Analysis
  - Dot, Cross, Triple Products, Differentiation of vectors
  - Line integrals, Green theorem
  - Solid angle calculation and integrating over a surface
  - Divergence, Curl, Stokes' theorem
- Complex Analysis
- Fourier Analysis
  - Fourier Series
  - Fourier Integral
  - Fourier Transforms

## IX. Basis for Final Grade

Provide a listing of assessments and their weighting in the semester total. In addition to (or even in lieu of) tests, consider exploring “authentic” assessments, which are based as closely as possible to real world experiences.

Assessment	Percent of Final Grade
Homework	30%
Exam 1	20%
Exam 2	20%
Final Exam	30%
	100%

## X. Make up Exam 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.

#### **XI. 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.

#### **XII. Class Website:**

Materials used for classes will be available on UCF Webcourses for download before each class. I

#### **XIII. Academic Integrity**

Students should familiarize themselves with UCF's Rules of Conduct at <http://osc.sdes.ucf.edu/process/roc> According to Section 1, "Academic Misconduct," students are prohibited from engaging in

- 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.
- 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.
- 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.
- Falsifying or misrepresenting the student's own academic work.
- 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.
- Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.
- Helping another violate academic behavior standards.

For more information about Academic Integrity, consult the International Center for Academic Integrity <http://academicintegrity.org>.

For more information about plagiarism and misuse of sources, see "Defining and Avoiding Plagiarism: The WPA Statement on Best Practices" <http://wpacouncil.org/node/9>.

#### **XIV. 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 <<http://goldenrule.sdes.ucf.edu/docs/goldenrule.pdf>>. UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and when necessary respond to academic misconduct. Penalties can include a failing grade in an assignment or in the course, suspension or expulsion from the university, and/or a "Z Designation" on a student's official transcript indicating academic dishonesty, where the final grade for this course will be preceded by the letter Z. For more information about the Z Designation, see <http://goldenrule.sdes.ucf.edu/zgrade>

#### **XV. Students with Special Testing/Learning Needs:**

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.

#### **XVI. Religious Observances**

Students must notify their instructor in advance if they intend to miss class for a religious observance. For more information, see the UCF policy at <http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALJan19.pdf>

### XVII. 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.

### XVIII. 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 [http://emergency.ucf.edu/emergency\\_guide.html](http://emergency.ucf.edu/emergency_guide.html).
- 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 <http://www.ehs.ucf.edu/AEDlocations-UCF> (click on link from menu on left).
- 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>).

### XIX. Relationship of Course to ABET Criteria

ABET Criteria (Adopted 2019)	Level of Emphasis During Course (Low, Medium, High)
1. Graduates have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	High
2. Graduates have an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	Low
3. Graduates have an ability to communicate effectively with a range of audiences.	Low
4. Graduates have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	Low
5. Graduates have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	Low
6. Graduates have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
7. Graduates have an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Moderate