UNIVERSITY OF CENTRAL FLORIDA

OSE 4240 - Introduction to Optical Design

Section: 0001

Optics and Photonics

Course Information

Term: Spring 2025
Class Meeting Days: TR
Class Meeting Time: 06:00PM - 07:15PM
Class Meeting Location: CROL 0102
Modality: P
Credit Hours: 3.00

Instructor Information

Sean Pang
Title: Associate Professor
Office Location: A235
Office Hours:
email to schedule
Email: pang@creol.ucf.edu

Teaching Assistants

NA

Course Description

OSE 4240 OPT-OPT 3(3, 0)Introduction to Optical Design: PR: OSE3200 and OSE 3052. Introduction of the main concepts in optical system design. Discussion on aberration theory. Analysis of the performance of the optical system. Assessment of image quality using optical design software. Spring

Introduction of the main concepts in optical system design. Discussion on aberration theory. Analysis of the performance of the optical system. Assessment of image quality using optical design software.

Detailed Description:
Analysis of optical systems consisting of lenses, mirrors, and apertures. Image plane, principal planes, and entrance and exit pupils. Magnification, field of view, F number, image-plane irradiance. Assessment of image quality resulting from diffraction and geometrical and chromatic aberrations, using optical design software. Analysis and design of photonic systems including systems consisting of waveguides and integrated-optic components. Numerical simulation using photonic design software.

Student Learning Outcomes

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

- Master the concept of ray-tracing and understand the aberration theory.
- Evaluate the performance for imaging optical system based on aberration theory.
- Understand the major design constraints in manufacturing and properties in optical materials.
- Get familiar with common lens-based imaging instruments and design criteria.
- Design simple imaging optical systems using commercially available software (Zemax).

Course Materials and Resources

Course Notes/Slides

Recommended Course Materials

Title: Introduction to Lens Design: With Practical Zemax Examples
Publisher: Willmann-Bell
Publication Date: 2002

Title: Optical System Design, 2nd ed
Publisher: MacGraw-Hill
Publication Date: 2008

Course Assessment and Grading Procedure

Creteria	Grade Weight
Homework (4-5)	60%
Midterm Exam	20%
Final Project	20%
Total	100%

Assignment Schedule

Due Date	Assignment Name	Assignment Type	Points
1/10/25	Attendance	Assignment	1

Grading Scale

Letter Grade	Percentage
A	90-100%
B	80-89%

Letter Grade	Percentage
C	70-79%
D	60-69%
F	0-59%

Policies for Course Grade

Missed/Late Assignments

The half life time of your homework is 1 week. For example, if you are 3 days late, and you get 80% of the problems correct. You will get 0.8* (1/2)^(3/7)=0.594 (59.4%). If you submit within 24-hour grace period, no points will be deducted.

Course Accessibility

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) (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.

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:

a. 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 the 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.

b. Any student who knowingly helps another violate academic behavior standards is also in violation of the standards.

c. 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 written 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.

d. 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 diversity and inclusion, Title IX, accessibility, or UCF’s complaint processes contact:

- Title IX – OIE – Office of Institutional Equity & 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 abusive or discriminatory behavior by any faculty or staff member, contact the Office of Institutional Equity online or at 407-823-1336. You can also choose to report using the UCF Integrity Line and can report anonymously or as yourself at 1-855-877-6049 or 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 related arrangements.

Campus Safety

At UCF 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 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

Week	Topic
1	Introduction of optical design. Review of geometrical optics From Maxwell's equation to ray tracing.
2	Snell's law/Fermat Principle. Spherical surface expansion and paraxial ray tracing approximation. Thin Lenses. Newton's formula. Thin lens system.
3	Key concept for ray tracing: stops and pupils, Key concept for ray tracing: marginal and chief ray, cardinal point, principle plane
4	Matrix representation. Invariants. Paraxial ray tracing using spread sheet. Paraxial ray tracing calculation example.
5	Calculating pupils, focal length using spread sheet. Zemax Introduction Non paraxial ray tracing. Wavefront/lateral aberration
6	MTF PSF, 3rd order aberrations I (Seidel's aberrations) 3rd order aberrations II (Seidel's aberrations)

Week	Topic
7	3rd order aberrations III Calculation (Seidel’s aberrations using spreadsheet) Lens Design (thin lens bending)
8	Lens Design (stop shifting) Lens Design Examples (Wollaston landscape lens)
9	Mid-Term Review Mid-term Exam
10	Spring Break
11	Mid-term Exam Q&A. Lens Design (lens splitting)
12	Lens Design Example (lithography lens) Chromatic aberration and lens material
13	Secondary color and Achromatism Lens Design Example (Achromatic doublets)
14	Symmetry in Lens Design Lens Design Examples (Double Gauss Lens 1)
15	Lens Design Examples (Double Gauss Lens 2)
16	Final Project Q&A