UNIVERSITY OF CENTRAL FLORIDA

OSE 6242 - Infrared Systems

Section: 0001

Optics and Photonics

Course Information

Term: Spring 2026
Class Meeting Days: MW
Class Meeting Time: 01:30PM - 02:45PM
Class Meeting Location: CROL 0102
Modality: P
Credit Hours: 3.00

Instructor Information

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Course Description

OSE 6242 OPTIC-OPTICS 3(3,0)Infrared Systems: PR: GS in Electrical Engineering, or GS in Optics and Photonics, or C.I. This course provides the background, theory, and practice of how to design, analyze, and test high performance infrared imaging systems. Fall.

The course focuses on the measurement of incoherent infrared light and its spatial, temporal, and spectral characteristics, as well as sensitive detection of infrared radiation. First, the course introduces radiometry—a set of concepts for measuring electromagnetic radiation,—and defines radiometric quantities and units of measurement. Next, we'll review the theory of black body radiation and concepts such as shot noise, Johnson noise, and background thermal noise that limit the signal-to-noise ratio of infrared detection. We will then look at various infrared detectors, from photon to thermal detectors, and their characteristics such as sensitivity, spectral characteristics, and speed. Finally, we will review the most advanced detector systems, such as superconducting single photon detectors, detectors based on optically coupled cantilevers, and focal plane detector arrays.

Student Learning Outcomes

After completion of this course, students will gain a theoretical foundation of radiometry, the principles of infrared detection, as well as knowledge of different types of detectors and arrays. The course will allow them to (i) apprehend the fundamental laws of nature that limit the sensitivity of infrared detection, (ii) understand the advantages and disadvantages of different types of detectors, and (iii) gain a clear idea of how to select an infrared detector or detector array for a specific application.

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Required Course Materials and Resources

This is a self-contained course. No required course materials or supplementary resources are necessary.

Course Assessment and Grading Procedure

Basis for the Final Grade

Final Grade

Assessment	Percent of Final Grade
Homeworks (once a week)	25 %
Exam 1 (open book)	25 %
Exam 2 (open book)	25%
Final Exam (open book)	25 %
	100%

Grading Scale

Grading Scale

Letter Grade	Percentage
A	94-100%
A-	90-93%
B+	87-89%
B	84-86%
B-	80-83%
C+	77-79%
C	74-76%
C-	70-73%

Letter Grade	Percentage
D+	67-69%
D	64-66%
D-	61-63%
F	0-60%

Policies for Course Grade

Makeup Work Policy: There will be no make up exams, except for extremely special circumstances.

Missed/Late Assignments: Late homework submission penalty: 10% will be deduced from the grade for each day of the delay.

Attendance: For the face-to-face students – attendance is required.

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 assessment, 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" designated 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 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 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 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

Schedule

	date	Title
1	12-Jan (Mo)	Lecture 1. Introduction, logistics. Radiometry, and its quantities and units.
2	14-Jan (Wed)	Lecture 2. Theory of blackbody radiation.
3	19-Jan (Mo)	No class, Martin Luther King Jr Day
4	21-Jan (Wed)	Lecture 3. Different mechanisms of optical detection.
5	26-Jan (Mo)	Lecture 4. Noise in optical detection-I.
6	28-Jan (Wed)	Lecture 5. Noise in optical detection-II.
7	2-Feb (Mo)	Lecture 6. Figures of merit for optical detectors. Responsivity. Noise equivalent power (NEP). Detectivity D*.
8	4-Feb (Wed)	Lecture 7. Detectors' bandwidth, speed, and their relation to noise.
9	9-Feb (Mo)	Lecture 8. Photoemissive detectors. Photomultipliers.
10	11-Feb (Wed)	Lecture 9. Introduction to semiconductor physics.
11	16-Feb (Mo)	**Exam 1 (open book)**
12	18-Feb (Wed)	Lecture 10. Photoconductive detectors
13	23-Feb (Mo)	Lecture 11. Photovoltaic p-n and p-i-n detectors. Avalanche detectors.
14	25-Feb (Wed)	Lecture 12. Thermal detectors-I. Thermopiles. Bolometers.
15	2-Mar (Mo)	Lecture 13. Thermal detectors -II. Pyroelectric detectors. Golay cells.
16	4-Feb (Wed)	Lecture 14. Schottky-barrier photodiodes.
17	9-Mar (Mo)	Lecture 15. Intrinsic and extrinsic silicon and germanium detectors.
18	11-Mar (Wed)	**Exam 2 (open book)**
19	16-Mar (Mo)	**Spring Break**
20	18-Mar (Wed)	**Spring Break**
21	23-Mar (Mo)	Lecture 16. III-V detectors. InAs, InSb
22	25-Mar (Wed)	Lecture 17. IV-VI detectors. PbS, PbSe.
23	30-Mar (Mo)	Lecture 18. HgCdTe (MCT) detectors.
24	1-Aprr (Wed)	Lecture 19. Quantum well infrared photodetectors (QWIP).
25	6-Apr (Mo)	Lecture 20. Detectors based on superconductors and optically coupled cantilevers.
26	8-Apr (Wed)	Lecture 21. Coherent detection. Heterodyning

27	13-Apr (Mo)	Lecture 22. Detection via frequency upconversion. Electro-optic sampling.
28	15-Apr (Wed)	Lecture 23. Detector focal plane arrays.
29	20-Apr (Mo)	Lecture 24. Thermal-imager systems.
30	22-Apr (Wed)	Lecture 25. Hyper-spectral imaging. Guest lecture “IR systems in astronomical observations”.
31	27-Apr (Mo)	Refresher before the Final Exam
32	29-Apr (Wed)	Prepare for the Final Exam (study day)
32	4-May (Mo)	**Final Exam (open book)**
33	**6-May (Wed)**	**Final Grades** (officially due 8-May before 12 pm noon)