UNIVERSITY OF CENTRAL FLORIDA

OSE 6313 - Materials for Optical Systems

Section: 0001

Optics and Photonics

Course Information

Term: Spring 2025
Class Meeting Days: TR
Class Meeting Time: 09:00AM - 10:15AM
Class Meeting Location: CROL A214
Modality: P
Credit Hours: 3.00

Combined Section Information

This syllabus applies to sections OSE 6313 0001, OSE 6313 0V02.

Instructor Information

Kathleen Richardson
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Course Description

OSE 5313 OPT-OPT 3(3, 0)Materials for Optical Systems: Graduate standing or C.I. Course reviews attributes of optical materials, physical properties and structural origin to predict performance and limitations of optical materials devices and components in optical systems. Occasional

The OSE 5313 OPT course description as published is incorrect. Please disregard.

OSE 6313 is a graduate course which has no pre-requisites other than completion of a BS in Optics, Photonics, Materials Science and Engineering, Physics, Chemistry or permission of the instructor. Senior level undergraduates with preparation associated with the content will be considered. This course will review key attributes of optical materials that allow them to be used in a range of applications. Physical properties and their structural origin will be used to predict performance and limitations of these materials as used in devices and components in optical systems.

Student Learning Outcomes

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

- Understand key attributes of optical materials integral to their use in modern optical systems.
- Delineate material properties for optical crystals, glasses, semiconductors, ceramics and polymers important to use in optical applications.
- Understand fundamentals of material optical properties due to material type.

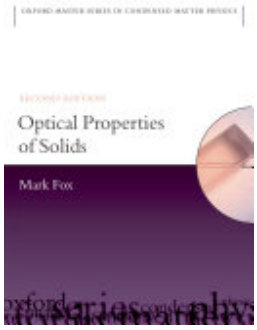
- Be able to critically evaluate the role of material processing to ultimate material performance
- Assess the relationship between material processing (melting, growth or deposition), manufacturing (optical fabrication) and resulting optical properties and the costs that go into selection of a desirable optical material for use in a proposed optical design.
- Be able to correlate the role of processing method and thermal history, electronic and crystallographic-specific properties on the candidate material and its trade space (advantages versus disadvantages) for its specific use in either the generation and/or propagation of light.
- Evaluate key material attributes that will limit, in-service optical performance.

Course Materials and Resources

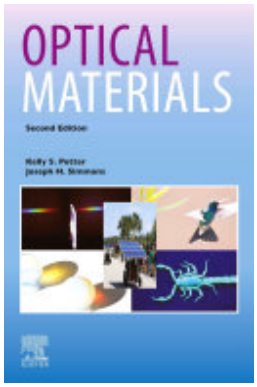
Infrared Window and Dome Materials
Authors: Daniel C. Harris
Publisher: SPIE-International Society for Optical Engineering
Publication Date: 1992-01-01
Online Access: e-book available in UCF library

Transparent Ceramics
Subtitle: Materials, Engineering, and Applications,
Authors: Adrian Goldstein, Andreas Krell, Zeev Burshtein
Publication Date: 2020
Online Access: e-book available, UCF library

Handbook of Glass
Publisher: Wiley
Publication Date: 2019
Online Access: e-book available, UCF library



Optical Properties of Solids
ISBN: 9780199573363
Authors: Mark Fox
Publisher: Oxford University Press
Publication Date: 2010-03-25



Optical Materials
ISBN: 9780128226490
Authors: Kelly S. Potter, Joseph H. Simmons
Publisher: Elsevier
Publication Date: 2021-04-22

Recommended Course Materials

Title: TBD

Course Assessment and Grading Procedure

To check on whether they are available on e-books, check here https://library.ucf.edu/textbook-affordability/etextbooks/. You will be asked to log on with your NID, then search by course number or instructor name.

Grading Scale

COURSE GRADING, RUBRICS and ASSESSMENT FOR SUCCESS:

Homework assignments (6-8) – 200 pts 20 %

Quizzes (~ 10) – 100 pts	10%
Midterm Exam – 200 pts	20 %
FINAL Project and participation – 200 pts	20 %
Final Exam – 300 pts	30 %

Final grades will be based on total of fraction of 1000 pts

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

Policies for Course Grade

Homework, Group project, Exams, Policy

HOMEWORK and GROUP PROJECT: Homework assignments will be a combination of reading assignments, problems from select textbooks, and the FINAL PROJECT (live/virtual and social distance-permitting) will involve critical thinking related to an actual industry-relevant materials problem. Whether the final project is an individual or group project will depend on the number of students enrolled in the class.

EXAMS: The announced MIDTERM exam is worth 20% of your grade (200 pts) and the FINAL is 30% (300pts). It will be determined in advance (and you'll be notified) whether they are open book, closed book or a combination of both, and whether they will be completed during class time, or as take home exams. Most questions (in a written exam) will be multiple choice, short answer, or short essay, based on classroom lectures and reading assignments.

For in-class section students, you MUST be present to take/submit your exams. Take home exams will be uploaded to WebCourses. In emergency situations – if you are sick, or have to be away for urgent reasons – you must notify me before the class and have documentation related to your absence. I will confirm receipt of this notification. No make-up exams will be offered.

Assignments, Missed/Late Submission, Honor Code

HONOR CODE

All assignments and exams must be done on your own. All students at UCF are governed by the provisions of the Golden Rule Handbook. We take the honor code VERY SERIOUSLY and any violations will be reported and may result in dismissal from the class and/or other penalties.

SYLLABUS, ASSIGNMENT SUBMISSION VIA WEBCOURSES and ADDITIONAL INFO

Modifications to the syllabus and course schedule may occur during the semester. Any change will be announced in class and posted online. Please check webcourses@ucf regularly where copies of all course notes/reading assignments will be posted. Assignments (and exams if appropriate) are expected to be submitted electronically to the instructor by 5pm on the due date (start of class) unless another submission time is stated. No late submissions are allowed. Double-sessions (or extra classes) may be scheduled if needed.

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.

Attendance and Class lectures/notes

In class attendance and participation is expected of all students; however, virtual attendance is allowed as needed. In-class quizzes may occur during any scheduled class session.

Unauthorized Distribution of Class Notes

Third parties may attempt to connect with you to sell your notes and other course information from this class. Distributing course materials to a third party without Prof. Richardson's authorization is a violation of our University's Rules of Conduct. Please be aware that such class materials that may have already been given to such third parties may contain errors, which could affect your performance or grade.

Recommendations for success in this course include coming to class on a routine basis, visiting me during my office hours, and making use of the Student Academic Resource Center (SARC), the University Writing Center (UWC), the Math Lab, etc. If a third party should contact you regarding such an offer, I would appreciate your bringing this to my attention. We all play a part in creating a course climate of integrity.

Class lectures will be recorded through webCourses for review and future study purposes. Students may use the video or audio of a class lecture for a class in which the student is enrolled for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach enrolled students about a particular subject.

Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion (except when incidental to and incorporated within a class lecture), clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, private conversations between students in the class or between a student and the faculty member, and invited guest speakers is prohibited.

Recordings may not be used as a substitute for class participation and class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct as described in the Golden Rule.

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

See DRAFT schedule below - this is subject to change and will be regularly updated on WebCourses.

Class Schedule rev 122024

Lecture	Dates	Content	Instructor
1	7 January	INTRODUCTION, Syllabus review, WebCourses, Library access; attendance, assignments and expectations	KCR
2	9 January	Optical Material Selection – working from a 'print'	KCR
	10 January	DROP/SWAP deadline	
3	14 January	Chemical Bonding and Material Properties – review	KCR
4	16 January	Optical Glasses – basics, processing and properties	KCR
5	21 January	Crystallization in glass	KCR
6	23 January	Optical Glass and Key Issues for Material Selection – part 1 (recorded); part 2: Applications and Q&A (LIVE) ***GUEST LECTURE – Dr. Ulrich Fotheringham, Exec. Scientist, SCHOTT AG (Germany)***	KCR/UF
7	28 January	Optical Glass Ceramics – applications	KCR
8	**FRIDAY** 31 January	Optical Ceramics ***GUEST LECTURE – Prof. Romain Gaume, CREOL/NanoScience***	RG
9	4 February	Optical Crystals: properties and processing methods ***GUEST LECTURE – Ms. Melissa Seitz, Engineer, Coherent AD***	KCR/MS
10	6 February	Optical Properties of solids – basics	KCR
11	11 February	Optical Properties of solids – characterization methods	KCR
12	13 February	Optical Properties of solids – spectroscopic structural tools	KCR
13	18 February	Photosensitive materials – mechanisms and measurement tools	KCR
14	20 February	Photosensitivity - examples and case studies	KCR
15	25 February	GRIN design and materials ***GUEST LECTURE – Prof. Duncan Moore, University of Rochester***	KCR/DM
	27 February	MID-TERM EXAM due – no class	
	4 March	***FINAL PROJECT Discussion and Assignments***	KCR
16	**FRIDAY** 7 March	Optical Thin Films: ARs, HRs and Specialty Coatings (VIRTUAL) ***GUEST LECTURE – Mr. Corey Bungay, LMCO, MFC Orlando***	KCR
17	11 March	Physical Properties: **Mechanical**, Thermal, Chemical – Part 1	KCR
18	23 March	Physical Properties: Mechanical, **Thermal**, Chemical – Part 2	KCR
	18-20 March	NO CLASS – SPRING BREAK	
19	25 March	Physical Properties: Mechanical, Thermal, **Chemical** – Part 3	KCR
XXX		**Lab practical at OML**	KCR/RS
20	27 March	Semiconductor Materials *(Virtual)* ***GUEST LECTURE - Prof. Myungkoo Kang, Alfred University***	KCR/MK
	28 March	WITHDRAWL DEADLINE	
21	1 April	Optical Fibers *(Virtual)* ***GUEST LECTURE – Prof. Laeticia Petit, Tampere Univ. Finland***	KCR/LP
	3 April	3 min abstracts (recorded PPT and written 2 pg 'r) – FINAL PROJECTS – uploaded to WEBCOURSES – 5pm	
22	8 April	Optical Manufacturing – design, specifications and testing – *TBD* ***GUEST LECTURE – Dr. Jessica DeGroot-Nelson, Edmund Optics, Barrington NJ***	
23	10 April	Multi-material integration photonics *– device challenges and issues for integrated photonic systems*	KCR
24	15 April	Optical Phase Change Materials (O-PCMs) *– design and fabrication needs*	KCR/ RS/DW
XX	DATE – DCS week	***GUEST LECTURE/visit – Ms. Melissa Seitz, Engineer, Coherent AD***	KCR/MS
	17 April	FINAL PROJECTS – presentations (random draw) ***ALL written reports and PPTs due – 8am***	
	21 April 22 April	Last day of classes (MONDAY) Study day (TUESDAY)	
	24 April (THURS)	**FINAL EXAM DUE (8am) (THURSDAY)**	