

EE 4380 / EE 5380 Principles of Photonics and Optical Engineering

Fall Semester 2023

Monday/Wednesday 4:00–5:20 pm, ERB 129

Instructor: Michael Vasilyev, Professor **Office:** NanoFAB Ctr, Rm. 202C
Office Hours: M, W 2:00–3:50 pm **Phone:** (817) 272-1224
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Required Textbook: E. Hecht, “Optics,” 5th ed., Pearson Education, 2016
(this book is on reserve in the Central Library).

Reference Texts:

- 1) “Introduction to Modern Optics,”
G. R. Fowles, 2nd ed., Dover Publications, 1989.
- 2) “Laser Electronics,”
J. T. Verdeyen, 3rd ed., Prentice Hall, 1994.
- 3) “Fundamentals of Photonics,”
B. E. A. Saleh and M. C. Teich, 2nd ed., John Wiley and Sons, 2007.
(These books are on reserve in the Central Library.)

Course Learning Objectives: Upon completion, the students will be able to understand the propagation of light in free space, at dielectric interfaces, and in birefringent materials; calculate the polarization state after polarizers and waveplates; design optical modulators based on Kerr, Pockels and Faraday effects; choose proper parameters of Fabry-Perot interferometer for optical filtering; design simple multiplayer coating for high or low reflectivity; and determine the location and size of images in an optical system consisting of spherical lenses and mirrors.

Course Description: The course introduces the basics of optical fields and their applications to lasers, optical fibers, and photonic signal processing, i.e., how light is used in modern systems for encoding, manipulating, transmitting, storing, and retrieving information. It covers light propagation in isotropic and birefringent optical media, behavior at dielectric interfaces, interference, optical cavities and principles of laser action, the basics of optical waveguides (including optical fiber), and electro- and acousto-optic modulation. Emphasis is given to the design and analysis of optical devices, and their applications in communications and signal processing.

Tentative topic schedule (instructor reserves the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course):

- L1: Introduction
- L2–6: Review of electromagnetic fields and waves
- L7–8: Optical waves at dielectric boundaries: reflection and transmission
- L8–9: Dielectric waveguides, including optical fiber
- L9–11: Propagation in anisotropic media
- L12: Electro-optic and acousto-optic modulation
- L13–15: Interference and Fabri-Perot resonators
- L16: Fundamentals of lasers
- L17: Dielectric coatings
- L17–18: Basic diffraction and diffraction gratings
- L19: Gaussian beams
- L19–22: Geometrical optics, lenses, mirrors, and prisms
- L23: Ray tracing with ABCD matrices, optical resonator stability
- L24: Final exam review

Course Evaluation and Final Grade:

Midterm exam	50%
Final exam	50%

Face Covering Policy: While the use of face coverings on campus is no longer mandatory, all students and instructional staff are welcome to wear face coverings while they are on campus or in the classroom.

Attendance: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. **As the instructor of this section, I strongly encourage every student to attend the class, and I may take attendance sporadically.** However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://wweb.uta.edu/ao/fao/>).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting:

- The Office for Students with Disabilities, (OSD) www.uta.edu/disability or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

- Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: *The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.*

Title IX Policy: The University of Texas at Arlington (“University”) is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Jean Hood, Vice President and Title IX Coordinator at (817) 272-7091 or jmhood@uta.edu.*

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington’s tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents’ Rule* 50101, §2.2, suspected violations of university’s standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>.

Diversity, Equity, and Inclusion (DEI) policy: The University is committed to Diversity, Equity, Inclusion (DEI) [principles and initiatives](#) to ensure success for all students, staff, and faculty, regardless of identity or cultural background, as highlighted in the University’s vision statement “*The diverse student body shares a wide range of cultural values and the University community fosters unity of purpose and cultivates mutual respect.*” Following the University, the College of Engineering has developed its own [DEI initiatives](#). As a faculty member and instructor in the College of Engineering, during this course I intend to follow and implement norms in our student faculty interactions that uphold University and College of Engineering DEI principles and initiatives. University values are affirmed by the DEI stance of professional engineering organizations such as, the National Society of Black Engineers, National Society of

Hispanic Engineers, Society of Women Engineers, Engineering Accreditation Commission (ABET), and the National Society of Professional Engineers: “*Engineers shall be guided in all their relations by the highest standards of honesty and integrity. Engineers shall treat all persons with dignity, respect, fairness and without discrimination.*” If you experience a violation of DEI principles in our course, feel free to contact me, or the College of Engineering Student [Ombud’s-Team](#), or the Chair of your Department, or the College Associate Dean of Graduate Affairs if you are a graduate student.

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as “lecture,” “seminar,” or “laboratory” are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback via the SFS database is aggregated with that of other students enrolled in the course. Students’ anonymity will be protected to the extent that the law allows. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Academic Success Center

The Academic Success Center (ASC) includes a variety of resources and services to help you maximize your learning and succeed as a student at the University of Texas at Arlington. ASC services include supplemental instruction, peer-led team learning, tutoring, mentoring and TRIO SSS. Academic Success Center services are provided at no additional cost to UTA students. For additional information visit: [Academic Success Center](#). To request disability accommodations for tutoring, please complete this [form](#).

The [IDEAS Center](#) (2nd Floor of Central Library) offers **FREE** [tutoring](#) and [mentoring](#) to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.