

EEL 4930 Optical Engineering

1. **Catalog Description** (3 credits): This course introduces the fundamentals of optics and photonics, including interference, diffraction, dispersion, polarization, fiber optics, photodetectors, image sensors, displays, LEDs, LDs, and lasers, as well as their applications in imaging, display and detection, such as fluorescent microscopy, light detection and ranging (LiDAR) and virtual reality (VR).
2. **Pre-requisites and Co-requisites:** PHY 2049 or equivalent
3. **Course Objectives:** The objective is to give students a comprehensive understanding of the fundamentals of optics and photonics and their applications to modern optical systems for detection, recording, display, imaging and communications. Another objective is to provide exposure to some frontier fields in optical engineering.
4. **Contribution of course to meeting the professional component** (ABET only – undergraduate courses) **Example (must equal the credit hours of the course):** This course consists of 1.5 credits of Engineering Design and 1.5 credits of Engineering Science
5. **Relationship of course to program outcomes:** Skills student will develop in this course (ABET only undergraduate courses)

Engineering Criteria: a, c, e, g, k

EE Program Criteria: EE1, EE2

6. **Instructor:** Prof. Huikai Xie
 - a. Office location: 221 Larsen Hall
 - b. Telephone: 846-0441
 - c. E-mail address: hkx@ufl.edu
 - d. Web site: E-Learning
 - e. Office hours: TBD
7. **Teaching Assistant:** TBD
 - a. Office location
 - b. Telephone
 - c. E-mail address
 - d. Office hours
8. **Meeting Times:** TBD
9. **Class/laboratory schedule:** Three lectures per week; 50 minutes per lecture
10. **Meeting Location:** TBD

11. Material and Supply Fees: NA

12. Textbooks and Software Required

- a. Title: Optoelectronics and Photonics: Principles and Practices
- b. Author: S. O. Kasap
- c. Publication date and edition: 2013, 2nd edition
- d. ISBN number: 0132151499

13. Recommended Reading:

- Frank L Pedrotti, Leno M Pedrotti, and Leno S Pedrotti, *Introduction to Optics*, 3rd Ed., Prentice Hall, 2006.
- Warren J. Smith, *Modern Optical Engineering*, 4th Ed., McGraw-Hill, 2007
- Eugene Hecht, *Optics*, 4th Ed., Addison Wesley, 2001.
- Saleh, B., and M. Teich, *Fundamentals of Photonics*, Wiley, 1991.
- J.C. Palais, *Fiber Optic Communications*, 5th Ed., Prentice Hall, 2004.
- Olav Solgaard, *Photonic Microsystems: Micro and Nanotechnology Applied to Optical Devices and Systems*, Springer, 2010.

14. Course Outline (provide topics covered by week or by class period)

1) Lightwave fundamentals: Refraction and reflection; Wave equations, plane waves, and spherical waves; Dispersion and group velocity; Doppler effect; Total internal reflection; Polarization, polarizers, and wave-plates; Interference; and Diffraction, and Fresnel zone plates.

2) Image formation and optical instruments: Lens laws; Formation of images; Resolution and primary aberrations; Prisms and mirrors; Apertures and spatial filtering; Optical material types; and Optical coating. The human eye, optical microscopes, and the Hubble Space Telescope.

3) Optical detection: Optoelectronic effect; PN junction; Semiconductor detectors, including PN, PIN and Avalanche diodes; Photomultipliers; CCD imagers; Quantum efficiency; Noises; and SNR.

4) Lasers: Optical resonators; Fabry-Perot Etalon; Laser modes; Spectral bandwidth and coherence length; Solid-state lasers, diode lasers, and gas lasers; Holography.

5) Optical displays: Liquid crystals; Plasmas; LEDs; Flat panel displays; Introduction to MEMS; MEMS scanning mirrors; Digital micromirror devices (DMDs) and portable projectors; and MEMS-based Pico-projectors.

6) Optical systems: Laser scanning; LiDAR principles; LiDAR system design; LiDAR applications; Stereoscopic displays; VR principles; VR optical design; VR applications.

15. **Attendance and Expectations:** Attendance is required. Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

16. **Grading:**

Homework	25%
Quizzes	10%
Labs	5%
Project	10%
<u>Exams</u>	<u>50%</u>
	100%

Note that there are three hands-on optics labs and one term project in this course.

17. **Grading Scale:**

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
93-100	90-92	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	0-59

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Undergraduate students, in order to graduate, must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

18. **Make-up Exam Policy:** If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

19. **Honesty Policy** – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

“...failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures (<http://www.dso.ufl.edu/sccr/procedures/honorcode.php>)

20. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
21. **UF Counseling Services** –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
 - Career Resource Center, Reitz Union, 392-1601, career and job search services.
22. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.