



SYLLABUS

OPTI 430/530: Optical Communication Systems

Tuesday and Thursday 12:30-1:45 p.m.

Description of Course

Physics of optical communication components and their applications to communication systems. Topics include signal propagation through optical fiber with linear and nonlinear effects, optical signal generation and modulation, optical signal amplification, photodetection and noise generation, optical receiver design, bit error rate calculations, and system performance evaluation.

Instructor and Contact Information

Linran Fan, Meinel 527, 520-621-0174, lfan@optics.arizona.edu

Teaching assistants:

Kevin Meyer, kmeyer36@arizona.edu

TA office hours: Friday 1pm, 8th floor of OSC

A course D2L site is available with further information.

Course Format and Teaching Methods

This course will include a combination of lectures, student presentations and discussion. Students are responsible for accessing online materials.

Course Objectives and Expected Learning Outcomes

Expected Learning Outcomes:

Upon completion of this course students will be able to:

- describe and mathematically analyze optical components used in communication systems
- understand the principles of optical communication system design
- analytically evaluate the performance and technical merits of an optical communication system
- be conversant in the major application areas for optical communication systems.
- design an optical communication system
- identify and describe the major sources of noise and signal impairments in an optical communication system

Course Objectives:

During this course, students will study the major elements of optical communication systems and analytical methods to evaluate their performance and key design features. Students will examine and think critically about historical technology solutions in the evolution of optical communication

systems. Current methods of system analysis and design will also be studied and applied to problems in emerging applications.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending online lectures and other course events are vital to the learning process. As such, attendance is required at all lectures. Please be advised:

- If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructors if you will be missing an in person or online course.
- [Campus Health](#) is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
- Visit the [UArizona COVID-19](#) page for regular updates.

Required Texts or Readings

Required textbook: Kumar, S. and Deen, M J.: Fiber Optic Communication Systems, Wiley 2014

Note: available as an e-book

Several more advanced and comprehensive texts are recommended:

Agrawal, G.: Fiber-Optic Communication Systems, 4th Ed., Wiley 2010

Assignments and Examinations:

Homework will be assigned (due in one week).

Students are recommended for reading the corresponding chapters in the textbook.

Midterm and final exams will be inclusive of all material up to the date of the respective exam..

Final presentations:

Groups of students will be assigned technical papers related to a specific topic to study and individually present to the class in brief 10 min. slide presentations. Following the presentations, the students will engage in a discussion together with the class on the topic. Students will be graded based on their presentations and command of the subject matter.

Final Examination

Final Exam date: last lecture in-class

The final exam will cover all topics covered throughout the entirety of the course. Regulations:

<https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, & UA

Final Exam Schedule: <http://www.registrar.arizona.edu/schedules/finals.htm>

Grading Scale and Policies

20%	Presentations
30%	Homework
25%	Midterm
25%	Final

Late Penalty: Any assignments not turned in by the deadline will receive a 1 letter grade score reduction. Each additional week that an assignment is late will receive an additional letter grade reduction. Penalties apply to all assignments unless the student receives a prior penalty waiver from the instructor or other excused absence documentation.

Final letter grades will be separately determined for students enrolled in 430 and 530 based on scores for each exam and assignment/activity, weighted according to the distribution above, and following the respective standards for undergraduate and graduate grading.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Scheduled Topics/Activities (with references to main textbook chapters)

1. Introduction and Background

2. Optical Fibers (Chapter 1 2 & 10)

- Geometrical-Optics Description
- Wave Propagation
- Optical modes in Fiber
- Fiber Losses
- Dispersion
- Pulse propagation
- Nonlinear effect

3. Light sources (Chapter 3)

- Laser basics
- Light-Emitting Diodes
- Semiconductor Lasers
- Fiber laser
- Laser Characterization

4. Optical modulation (Chapter 4)

- Intensity Modulation - Direct Detection Systems
- Coherent modulation - detection detection
- Modulation formats: ASK, FSK, PSK, QAM
- Bi-error rates and receiver sensitivity
- Sensitivity degradation
- System performance

5. Optical Receivers (Chapter 5)

- Common Photodetectors
- Receiver Design

Receiver Noise & Sensitivity
Receiver Performance

6. Optical Amplifiers (Chapter 6)

Semiconductor Optical Amplifiers
Raman Amplifiers
Erbium-Doped Fiber Amplifiers

7. Performance analysis of optical links (Chapter 8)

Bit error rate
Q function
Rate limit

Note that material may be drawn from chapters not listed above and/or other readings and material provided in class.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive online environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Life Challenges

If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The [Dean of Students Office](#) can be reached at 520-621-2057 or DOSdeanofstudents@email.arizona.edu.

Physical and Mental-Health Challenges

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520) 621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

Academic Advising

If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the [Advising Resource Center](#) can guide you toward university resources to help you succeed.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:

<http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at

<http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions.

Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at

<http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.