ELEG 403 – Communication Systems Engineering

Credits: 3, Section: 01
Semester: Fall, Year: 2026
Meeting Days, Times, Location and Room:
Lecture: Tuesdays and Thursdays, 9:35-10:55 AM, Colburn Lab 109

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1. Instructor Information

Instructor Contact Information

Instructor name: Xiang-Gen Xia
Instructor preferred pronouns: he/him/his
Email address: xianggen@udel.edu
Office location: 311 Evans Hall
Office hours: Tuesdays and Thursdays 11:00 am -12:15 pm or by appointment

2. Course Description

Description

This course examines the basics of modern communications systems, including analog modulation, digitalization of analog sources, digital data transmission, and the performance of these systems in the presence of noise.

Prerequisites

Signal and Systems (ELEG305), and Probability, Statistics, and Random Signals (ELEG310)

Course Delivery

In person

3. Learning Outcomes

At the conclusion of this course, you should have the ability to:

1. Understand the differences between analog and digital communications
2. Characterize and quantify the performance degradations caused by channel impairments
3. Understand the basics of analog modulation techniques, and how to choose the appropriate technique for a specific application
4. Understand how analog signals are digitalized
5. Understand the principles of digital data transmission
6. Analyze the performance of simple digital communication systems
7. Understand key concepts in Information Theory and Error Correction Codes as applied to communication systems

Learning Resources

Required Learning Materials

Lathi and Ding, ***Modern Digital and Analog Communication Systems***, 5th Ed., Oxford University Press, 2019; ISBN-13: 978-0190686840

Technology

Canvas: In this class, Canvas, UD's online learning management system, will be used for course activities. All assignments will be posted through the Canvas course site unless otherwise directed. Information on how to use Canvas is available through the Canvas Student Guide. Canvas can also be accessed via MyUD.

Zoom: Zoom may be used in rare occasions. If this is the case, you will receive a meeting invitation with a specific web link and meeting ID number for use in this class. Zoom is a web-based application that can be used from a computer, tablet, or phone. From a computer, click the class web link and be sure to install the small program that will download to your computer. You only need to install the program once. From a mobile device, download the free Zoom app and type in the class meeting ID number. A microphone and camera are recommended for online meetings. Information on how to test your computer's audio and video can be found on Zoom's website. Learn more info about Zoom at UD.

Additional Learning Resources

Slides will be provided for each one of the chapters.

5. Learning Assessment

Final Grade Breakdown

The final course grade will be calculated using the following components:

Course Component	Percentage of Total
Homework	10%
Midterm 1 (Chapters 2-3)	10%
Midterm 2 (Chapters 1-4)	20%
Midterm 3 (Chapters 5-6)	25%
Final Exam	35%

Grading Scale

Students will be assigned a letter grade based on the following guidelines. Adjustments are possible at the end of the semester (in favor of the students).

Grade	Interval
A	90.0 and above
A-	80.0 to <90.0
B+	70.0 to <80.0
B	60.0 to <70.0

B-	55.0 to <60.0
C+	50.0 to <55.0
C	45.0 to <50.0
C-	40.0 to <45.0
D+	35.0 to <40.0
D	30.0 to <35.0
D-	25.0 to <30.0
F	<25.0

6. Course Calendar (guideline)

Date	Theme/Topic	Learning Outcomes Addressed	Readings/Assignments Due
Week 1	Introduction to Communication Systems. Review of Signals	1,2	Slides, Chapters 1,2
Week 2	Introduction to Communication Systems. Review of Signals	1,2	Slides, Chapters 1,2
Week 3	Fourier Transform and Transmission of Signals	2	Slides, Chapter 3 Homework 1 (September 9)
Week 4	Introduction to Communication Systems. Analog Modulations and Demodulations	1,3	Slides, Chapters 1,4 Homework 2 (September 16)
Week 5	Analog Modulations and Demodulations	3	Slides, Chapter 4 Homework 3 (September 27) Midterm 1 (September 23)
Week 6	Analog Modulations and Demodulations	3	Slides, Chapter 4 Homework 4
Week 7	Analog Modulations and Demodulations. Digitalization of Analog Source Signals	3,4	Slides, Chapters 4, 5 Homework 5
Week 8	Digitalization and Analog Source Signals. Probability	4,6	Slides, Chapters 5,7
Week 9	Random Processes	6	Slides, Chapter 8 Homework 6

Week 10	Principles of Digital Data Transmission	5,6	Slides, Chapter 6 Homework 7
Week 11	Principles of Digital Data Transmission	5,6	Slides, Chapter 6 Homework 8
Week 12	Principles of Digital Data Transmission	5,6	Slides, Chapter 6 Homework 9
Week 13	Performance Analysis of Digital Communication Systems	6	Slides, Chapter 9 (10)
Week 14	Introduction to Information Theory and Error Correcting Codes	7	Slides, Chapters 12,13 Homework 10

7. Course Policy Document

Course Specific Policies

Attendance

Absences on religious holidays listed in university calendars are recognized as an excused absence. Nevertheless, students are urged to remind the instructor of their intention to be absent on a particular upcoming holiday. Absences on religious holidays not listed in university calendars, as well as absences due to athletic participation or other extracurricular activities in which students are official representatives of the university, shall be recognized as excused absences when the student informs the instructor in writing during the first two weeks of the semester of these planned absences for the semester.

Communication

Course announcements will be posted using Canvas and PoBox. Please, e-mail your homework and any questions you may have directly to me.

Advanced automated tools (artificial intelligence or machine learning tools such as ChatGPT or Dall-E 2) cannot be used to solve homework problems unless permission is explicitly granted.

UD Policies

Academic Integrity

Please familiarize yourself with UD policies regarding academic dishonesty. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an assignment, to re-submit the same assignment for different classes, or to allow or assist another to commit these acts corrupts the educational process. Students are expected to do their own work and neither give nor receive unauthorized assistance. Complete details of the university's academic integrity policies and procedures can be found at sites.udel.edu/studentconduct/sgup/ Office of Student Conduct, 218 Hullihen Hall, (302) 831-2117. E-mail: student-conduct@udel.edu

Harassment and Discrimination

The University of Delaware works to promote an academic and work environment that is free from all forms of discrimination, including harassment. As a member of the community, your rights, resource and responsibilities are reflected in the non-discrimination and sexual misconduct policies. Please familiarize yourself with these policies at www.udel.edu/oei . You can report any concerns to the University's Office of Equity & Inclusion, at 305 Hullihen Hall, (302) 831-8063 or you can report anonymously through UD Police (302) 831-2222 or the EthicsPoint Compliance Hotline

at www1.udel.edu/compliance. You can also report any violation of UD policy on harassment, discrimination, or abuse of any person at this site: sites.udel.edu/sexualmisconduct/how-to-report/

Faculty Statement on Disclosures of Instances of Sexual Misconduct

If, at any time during this course, I happen to be made aware that a student may have been the victim of sexual misconduct (including sexual harassment, sexual violence, domestic/dating violence, or stalking), I am obligated by federal law to inform the university's Title IX Coordinator. The university needs to know information about such incidents to, not only offer resources, but to ensure a safe campus environment. The Title IX Coordinator will decide if the incident should be examined further. If such a situation is disclosed to me in class, in a paper assignment, or in office hours, I promise to protect your privacy--I will not disclose the incident to anyone but the Title IX Coordinator.

For more information on Sexual Misconduct policies, where to get help, and reporting information, please refer to www.udel.edu/sexualmisconduct. At UD, we provide 24/7/365 crisis assistance and victim advocacy and counseling. Contact 302-831-1001 to get in touch with a sexual offense support advocate, as well as confidential and anonymous counseling services for other concerns.

Accommodations for Students with Disabilities

Any student who thinks he/she may need an accommodation based on a disability should contact the Office of Disability Support Services (DSS) office as soon as possible. Students who have documentation of their need for accommodation should register via the SAM platform: andes.accessiblelearning.com/UDEL/. Reach DSS in the following ways: Phone: 302-831-4643, fax: 302-831-3261, DSS website. Email: dssoffice@udel.edu or visit at 240 Academy Street, Alison Hall Suite 130.

Non-Discrimination

The University of Delaware does not discriminate against any person on the basis of race, color, national origin, sex, gender identity or expression, sexual orientation, genetic information, marital status, disability, religion, age, veteran status or any other characteristic protected by applicable law in its employment, educational programs and activities, admissions policies, and scholarship and loan programs as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and University policies. The University of Delaware also prohibits unlawful harassment including sexual harassment and sexual violence.

For inquiries or complaints related to non-discrimination policies, please contact: Office of Equity & Inclusion- oei@udel.edu, 305 Hullihen Hall Newark, DE 19716 (302) 831-8063

For complaints related to Section 504 of the Rehabilitation Act of 1973 and/or the Americans with Disabilities Act, please contact: Office of Disability Support Services, dssoffice@udel.edu, Alison Hall, Suite 130, Newark, DE 19716 (302) 831-4643 OR contact the U.S. Department of Education - Office for Civil Rights