EENG 5810/4510 - Digital Communications
Fall 2023

Course Description:

This course introduces the basics for the analysis and design of digital communication systems. Topics include channel modeling, signal analysis, digital modulation schemes, optimum receivers for additive white Gaussian noise channels, and selected topics in advanced digital communications.

Learning Objectives:

The goals of this course are to expose the students to basic digital communication techniques, to provide the students knowledge of the design of digital communication systems as engineers, and to prepare the students for advanced topics in digital communications.

Lectures:

Tu, Th, 13:00 - 14:20, NTDP B227.

Instructor:

Hua Sun. Office: NTDP B225. Email: Hua.Sun@unt.edu.

Office Hours: Tu, Th, 14:30 - 15:30, NTDP B225.

TA:

Sudesna Das Rochi, Email: SudesnaDasRochi@my.unt.edu.

Office Hours: Mo, We, 13:00 - 14:00, NTDP B241.

Textbook:

John G. Proakis, Masoud Salehi, *Digital Communications*, ISBN 978-0-07-295716-7, McGraw-Hill, 5-th Edition.

Lecture notes and other supplementary materials are posted online.

Prerequisites:

Linear systems and elementary probability theory.

Grading Policy:

Homework: 15%

Matlab Projects (2): 10% + 15%

Midterm Exam: 30% (in class)

Final Exam: 30% (10:30 A.M. - 12:30 P.M., Thursday, Dec 14, NTDP B227)

Tentative Schedule:

Week	Date	Due	Topics	Reading
1	8/22		Course Introduction	Chapter 1
	8/24		Gram-Schmidt for Vectors, Low Pass Representation	Chapter 2.1, 2.2
2	8/29		Gram-Schmidt for Functions, Best Approximation	Chapter 2.2
	8/31		Discrete and Continuous Probability	Chapter 2.3
3	9/5		Binary Amplitude Modulation	Chapter 3.1
	9/7		Random Process	Chapter 2.7
4	9/12	Homework 1	Amplitude Modulation	Chapter 3.2-1
	9/14		Phase Modulation	Chapter 3.2-2
5	9/19		Quadrature Amplitude Modulation	Chapter 3.2-3
	9/21		Multi-dimensional Modulation	Chapter 3.2-4
6	9/26		Modulation with Memory	Chapter 3.3
	9/28	Homework 2	Midterm Review	
7	10/3		**Midterm**	
	10/5		General Detection	Chapter 4.1
8	10/10		Gaussian Detection	Chapter 4.2-1
	10/12		Optimal Detection for Orthogonal Signaling	Chapter 4.4
9	10/17		Match Filter Detector	Chapter 4.2-2
	10/19		Decision Region and Union Bound	Chapter 4.2-3
10	10/24		Error Probability for PAM	Chapter 4.3-1
	10/26	Homework 3	Error Probability for PSK	Chapter 4.3-2
11	10/31		No Lecture	
	11/2	Project 1	No Lecture	
12	11/7		Error Probability for QPSK	Chapter 4.3-3
	11/9		Error Probability for QAM	Chapter 4.3-3
13	11/14		Comparison of Signaling	Chapter 4.6
	11/16		Communication System	Chapter 4.3-4
14	11/21		Thanksgiving Break	
	11/23		Thanksgiving Break	
15	11/28	Homework 4	Detection with Uncertainty	Chapter 4.5
	11/30		Final Review	
16	12/5		Prefinal Week	
	12/7	Project 2	Prefinal Week	
Final	12/14			

General Policies:

• **Academic Integrity Standards and Consequences.** According to UNT Policy 06.003, Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

• **ADA Accommodation Statement.** UNT makes reasonable academic accommodation for students with disabilities. Students seeking accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide a student with an accommodation letter to be delivered to faculty to begin a private discussion regarding one's specific course needs. Students may request accommodations at any time, however, ODA notices of accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of accommodation for every semester and must meet with each

faculty member prior to implementation in each class. For additional information see the ODA website at disability.unt.edu.

• **Emergency Notification & Procedures.** UNT uses a system called Eagle Alert to quickly notify students with critical information in the event of an emergency (i.e., severe weather, campus closing, and health and public safety emergencies like chemical spills, fires, or violence). In the event of a university closure, please refer to Blackboard for contingency plans for covering course materials.

• **Attendance.** Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.