

## EE107 – Communication Systems

### Objectives

The goal of this course is to provide students with fundamental knowledge of a communication system in both analog and digital domains. We use mathematical tools and models to understand what a communication system consists of, how various communication techniques work, and at a basic level, how to evaluate their performance and what is involved in designing a communication system. Specifically, the course objectives are for students to

- Appreciate how a communication system can be described and designed using mathematical tools, especially based on signals/systems and probability concepts.
- Understand various concepts and techniques in a communication system, including analog and digital modulation techniques, quantization and coding, spectrum shaping, time and frequency division multiplexing.
- Perform experiments or simulation of certain techniques in lab and/or project settings.
- At a basic level, evaluate the performance of a technique and/or a communication system, and design to simple specifications.

### Prerequisites

- Signals and systems (EE23 or equivalence)
- Probability and statistics (EE24 or equivalence)

### Grading scheme and policies

Homework 20%, Quizzes 40%, Project/Labs 40%

(We reserve the right to change these weights based on the whole class performance.)

- Weekly homework comprises of analysis problems as well as Matlab problems. Doing the homework is essential for learning the materials and for doing well in the course. Students are encouraged to work on the homework in a group, but each person needs to write up and hand in their answers individually.
- The course project involves Matlab simulation of a complete communication system. Students work on the project in groups of two. Different group sizes (smaller or larger) need to get permission from the instructor first and will only be granted with sound reasons.
- The course has a couple of lab sessions to assist in the understanding of various techniques and getting some hand-on experience. Labs can be performed in groups of 2-3 students. Only one lab report is required per group.
- There will be 4 – 6 quizzes in total, dates as announced during the course.
- All quizzes are timed and closed book. For each quiz, each student can bring one (1) single-sided sheet of notes. The notes must be hand-written, not scanned nor photocopied.

**Textbook**

Proakis and Salehi, “*Fundamentals of Communication Systems*,” Pearson, 2<sup>nd</sup> ed., 2013.

**References** (recommended but not required)

- Simon Haykin and Michael Moher, “*Communication Systems*,” Wiley, 5th ed., March 2009.
- B.P. Lathi and Zhi Ding, “*Modern Digital and Analog Communication Systems*,” Oxford University Press, 4<sup>th</sup> ed., 2009.

**Canvas**

We will use Canvas as the main communication platform for the course this semester. We will post all homework assignments, labs, project description, lecture notes, and previous exams on Canvas. We will also use the discussion feature in Canvas for Q&A on any topic in the course. Students should check the course website in Canvas regularly for updates.

**Syllabus Outline**

No. of Lectures   Reading (Proakis)

	Topics	No. of lectures	Reading (Proakis)
1	Introduction	1	Ch. 1
2	Representation of signals and systems	3	Ch. 2, except 2.6
3	Amplitude modulation	3	Ch. 3 (3.5 as bonus)
4	Angle modulation	3	Ch. 4 (4.4 as bonus)
5	The transition from analog to digital	4	7.1, 7.2.1, 7.3, 7.4
6	Baseband digital transmission	4	8.1, 8.2, 8.3, 8.4.1 10.1, 10.2, 10.3
7	Band-pass digital transmission	4	8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.4, 8.7.1, 8.7.2
8	Information theory and capacity	1	12.5, 12.6
9	Communication system examples	1	3.5, 4.4, 7.6, 7.7, 11.6 (extras)