ECE 0402: Signals, Systems & Probability

Spring 2025 Course Syllabus

Lectures: Wednesdays 8:15am–11:00am at S105

Instructor: Guanqiang "Tim" Zhou <guanqiang.zhou@scupi.cn>

Office Hours: Thursdays 8:00am–11:00am at N512 (or by appointment)

Teaching Assistant: Junle Li <lijunle@stu.scu.edu.cn>

Textbooks:

- *Signals and Systems Using MATLAB*, Fourth Edition, by Luis F. Chaparro
- *Linear Systems and Signals*, Second Edition, by B. P. Lathi

Course Description

This course provides an introduction to the fundamental concepts of signals, systems, and probability theory. Topics covered include the analysis and representation of continuous-time signals, linear time-invariant (LTI) systems, Fourier and Laplace transforms, probability theory, and its applications to signal processing and system analysis. This course integrates concepts from mathematics, engineering, and computer science to provide students with the analytical tools needed to understand and design systems that process signals.

Course Objectives

By the end of this course, students will be able to:

- Understand and manipulate continuous-time and discrete-time signals.
- Analyze the behavior of linear time-invariant (LTI) systems.
- Apply mathematical tools for signal and system analysis, such as Fourier transform and Laplace transform.
- Grasp the fundamental principles of probability and statistics as they apply to signal processing and system modeling.
- Solve real-world problems using the principles of signals, systems, and probability.

Learning Outcomes

Upon successful completion of this course, students will acquire knowledge and skills in the following areas:

- **Signal Representation:** Understand and manipulate different types of signals, including periodic, aperiodic, and random signals.
- **System Analysis:** Analyze and characterize the behavior of LTI systems, including impulse response, convolution, and frequency response.
- **Transform Methods:** Apply Fourier and Laplace transforms to analyze signals and systems in both time and frequency domains.
- **Probability and Statistics:** Understand basic concepts of probability theory, including random variables, probability distributions, expected value, and variance.
- **Application to Engineering:** Apply probability and system analysis methods to real-world problems, such as noise filtering, signal reconstruction, and system design.

Tentative Lecture Schedule

Week	Course Topics
Week 1 (2/26)	Overview; Introduction to signals
Week 2 (3/5)	Basic signals and operations; Sketching signals
Week 3 (3/12)	System properties; LTI systems
Week 4 (3/19)	Impulse response; Convolution
Week 5 (3/26)	Midterm 1 (Time domain)
Week 6 (4/2)	Fourier series; Filtering
Week 7 (4/9)	Fourier transform (FT)
Week 8 (4/16)	FT properties; System response
Week 9 (4/23)	Sampling theory
Week 10 (4/30)	Laplace transform (LT); Differential equations
Week 11 (5/7)	Midterm 2 (Frequency domain)
Week 12 (5/14)	Inverse Laplace transform; Laplace properties
Week 13 (5/21)	Analyzing LTI systems using LT; Bode plots
Week 14 (5/28)	Introduction to probability theory
Week 15 (6/4)	Hypothesis testing
Week 16 (6/11)	Probability applications in ECE; Review
Week 17 (6/18)	Final Exam (Comprehensive)

Course Grading

- Attendance and Class Participation: 5%
- Homework: 15%
- Midterm Exam 1: 25%
- Midterm Exam 2: 25%
- Final Exam: 30%

Applicable ABET Outcomes

- Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Ability to communicate effectively with a range of audiences.
- Ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives.
- Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.