# ECE3084 Course Syllabus

### ECE3084

**Signals and Systems (3-0-0-3)**

### CMPE Degree

This course is Elective for the CMPE degree.

### EE Degree

This course is Required for the EE degree.

### Lab Hours

0 supervised lab hours and 0 unsupervised lab hours

### Course Coordinator

Wardi,Yorai

### Prerequisites

ECE 2026 [min C] and (ECE 2040 [min C] or (ECE3710 [min C] and MATH 2403/2413/24X3 [min C]))

### Corequisites

None

### Catalog Description

Continuous-time linear systems and signals, their mathematical representations, and computational tools; Fourier and Laplace transforms, convolutions, input-output responses, stability.

### Textbook(s)

Chen, *Signals and Systems* (3rd edition), Oxford University Press, 2004. ISBN 0195156617, ISBN 978-0195156614 (required)

*myDAQ*, National Instruments. (required)

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### Course Outcomes

Upon successful completion of this course, students should be able to:

1. Express continuous-time signals in mathematical form
2. Define and apply the Fourier transform
3. Analyze signals in terms of their frequency contents
4. Describe system behavior in terms of the Fourier transform
5. Apply the Laplace transform
6. Solve linear, ordinary differential equations using the Laplace transform
7. Derive transfer function representations of linear systems
8. Relate system stability to the properties of the transfer function
9. Explain the role of feedback in linear systems

10. Describe how continuous-time signals and systems are used in engineering applications

**Student Outcomes**

In the parentheses for each Student Outcome:
"P" for primary indicates the outcome is a major focus of the entire course.
“M” for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.
“LN” for “little to none” indicates that the course does not contribute significantly to this outcome.

1. ( P ) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. ( M ) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. ( LN ) An ability to communicate effectively with a range of audiences
4. ( LN ) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. ( LN ) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. ( LN ) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. ( LN ) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

**Topical Outline**

1. Introduction and motivation
   a. Engineering approximations and mathematical abstractions
   b. Continuous-time vs. discrete-time signals and systems
   c. Linear systems (superposition)
   d. Time invariance

2. Frequency-domain signal analysis
   a. Fourier series
   b. Continuous-time Fourier transforms
   c. Properties of Fourier transforms

3. Frequency-domain characterizations of linear systems
   a. Transfer functions (jw)
   b. Frequency responses

4. Time-domain characterizations of linear systems
   a. Differential equations
   b. Convolution
   c. Lumped vs. distributed systems

5. Discrete-time representations of continuous-time signals
   a. Nyquist sampling
   b. Filters (A/D -> filter -> D/A cascade)

6. Laplace-domain signal analysis

a. Forward and inverse Laplace transforms
b. Properties of Laplace transforms
c. Initial and final value theorems
d. Convolutions
e. Connections between Fourier and Laplace transforms

7. Laplace-domain characterizations of linear systems
   a. States
   b. Laplace-domain representation of ODEs
   c. Transfer functions (s); poles and zeros
   d. Responses (zero state, zero input)
   e. Laplace-domain electric circuit analysis
   f. Stability
   g. Feedback

Typical in-class labs may include:
Sensing and data filtering
Proportional feedback design
Signal generation and frequency analysis