

**Linear Systems I (55:040)**  
**(Required: All Tracks)**

**Catalog Description:**

Introduction to continuous and discrete time signals and systems with emphasis on Fourier analysis; examples of signals and systems; notion of state and finite state machines; causality; linearity and time invariance; periodicity; Fourier transforms; frequency response; convolution; IIR and FIR filters, continuous and discrete Fourier transforms; sampling and reconstruction; stability.

**Pre(co)requisites:**

59:008 [P] and 22M:034 [P]

**Textbook:**

V. Oppenheim and A. S. Willsky, Signals and Systems, 2<sup>nd</sup> Edition, Prentice Hall, 1997

**References:**

None

**Topics (Class Hours):**

- |   |  |
|---|--|
| 1. Signals and their basic operations (4)                 | and its properties and application (8)   |
| 2. Special examples of signals (2)                        | 7. Fourier series of discrete-time signals and its properties and applications (6) |
| 3. System properties (4)                                  | 8. Continuous-time Fourier transform and its properties and applications (8)       |
| 4. Linear time-invariant systems and their properties (2) | 9. Discrete-time Fourier transform and its properties and applications (6)         |
| 5. Linear differential and difference equations (3)       | 10. In-class examination (2)   |
| 6. Fourier series of continuous-time signals              |  |

**Laboratory Projects:**

None

**Class/Laboratory Schedule:**

Three 50 minute lectures per week; one 50-minute discussion section per week

**Writing Assignments and Oral Presentations:**

None

**Design Component:**

None

**Contribution to the Requirements of Criterion 5:**

Engineering topics: 2 s.h., Mathematics and Basic Sciences: 1 s.h.

### Course Goals: Basis for Assessment and Mapping onto Outcomes

Course Goal	Basis For Goal Assessment	Supports ABET Outcomes
1. Understanding of different types of signals and systems and their role in the modern world.	Homework, quizzes, exam questions	a(●), j(○)
2. Understanding of causal, linear, and linear time invariant systems.	Homework, quizzes, exam questions	a(●), e(●), j(○), k(●)
3. Understanding of periodicity in discrete and continuous time, and of Fourier series	Homework, quizzes, exam questions	a(●), e(●), j(○), k(●)
4. Understanding of frequency response and convolution.	Homework, quizzes, exam questions	a(●), e(●), j(○), k(●)
5. Understanding of discrete- and continuous time Fourier transform	Homework, quizzes, exam questions	a(●), e(●), j(○), k(●)
6. Understanding of stability.	Homework, quizzes, exam questions	a(●), e(●), j(○), k(●)
7. They will reinforce the theoretical knowledge acquired in lectures by Matlab assignments.	Homework, quizzes, exam questions	a(●), b(●), c(●), k(●)

○ denote moderate contribution to the outcome; ● denote substantial contribution to the outcome

#### Performance Criteria:

Instructor completes a Course Outcome Rating (COR) that quantitatively evaluates student performance for each course goal-related outcome using a standard scale (4.0 = outstanding ability; 3.0 = good ability; 2.0 = adequate ability; 1.0 = poor ability; 0.0 = no ability). Instructor chooses appropriate graded course artifacts (homework questions, exam questions, etc) for each outcome rating. COR scores below 2.5 are indicative of problems with meeting course goals/outcomes and COR scores below 2.0 indicate failure to adequately meet course goals/outcomes.

#### Prepared By:

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