

# ECE 3050: Signals and Systems

## Course Description

Linear systems and models in continuous and discrete time; convolution; Fourier series and transform; frequency response; Laplace transform; z-transform; applications.

**Prior Course Number:** 352

**Transcript Abbreviation:** Signals & Systems

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Undergrad

**Student Ranks:** Junior, Senior

**Course Offerings:** Autumn, Spring

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 14 Week

**Credits:** 3.0

**Repeatable:** No

**Time Distribution:** 3.0 hr Lec

**Expected out-of-class hours per week:** 6.0

**Graded Component:** Lecture

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** Prereq: 2020, 2050, and 2060; or 2100; and Math 2568 (568) or 571; and prereq or concur Math 2415; and enrollment in ECE or EngPhysics major.

**Exclusions:** Not open to students with credit for 352.

**Cross-Listings:**

**Course Rationale:** Existing course.

**The course is required for this unit's degrees, majors, and/or minors:** Yes

**The course is a GEC:** No

**The course is an elective (for this or other units) or is a service course for other units:** Yes

**Subject/CIP Code:** 14.1001

**Subsidy Level:** Baccalaureate Course

## Programs

| Abbreviation | Description            |
|--------------|------------------------|
| CpE          | Computer Engineering   |
| EE           | Electrical Engineering |

## Course Goals

|                                                                               |
|-------------------------------------------------------------------------------|
| Be competent with linear systems as approximate models of physical systems    |
| Master convolution for discrete-time and continuous-time linear systems       |
| Master Fourier series, Fourier transform, and discrete-time Fourier transform |
| Master frequency response concepts                                            |

|                                                                                           |
|-------------------------------------------------------------------------------------------|
| Master using Laplace transform techniques for solving linear differential equations       |
| Be competent in the use of Z-transform techniques for solving linear difference equations |
| Be exposed to the applications of signal and systems concepts.                            |

## Course Topics

| Topic                                                                                             | Lec | Rec | Lab | Cli | IS | Sem | FE | Wor |
|---------------------------------------------------------------------------------------------------|-----|-----|-----|-----|----|-----|----|-----|
| Modeling signals and systems                                                                      | 3.0 |     |     |     |    |     |    |     |
| LTI properties in time domain; stability                                                          | 2.0 |     |     |     |    |     |    |     |
| Convolution: computation in discrete and continuous time                                          | 4.0 |     |     |     |    |     |    |     |
| Fourier series                                                                                    | 4.0 |     |     |     |    |     |    |     |
| Fourier transforms                                                                                | 3.0 |     |     |     |    |     |    |     |
| Discrete-time Fourier transform                                                                   | 4.0 |     |     |     |    |     |    |     |
| Frequency response, Bode plots, and filters                                                       | 3.0 |     |     |     |    |     |    |     |
| Sampling                                                                                          | 2.0 |     |     |     |    |     |    |     |
| Laplace transform; solving ODEs; stability                                                        | 5.0 |     |     |     |    |     |    |     |
| Z-transform                                                                                       | 4.0 |     |     |     |    |     |    |     |
| Applications (e.g., system identification, tracking, stabilizing feedback, quadrature modulation) | 3.0 |     |     |     |    |     |    |     |
| Reviews                                                                                           | 3.0 |     |     |     |    |     |    |     |

## Representative Assignments

|                                                    |
|----------------------------------------------------|
| Textbook problems                                  |
| Computed examples on measured signals using Matlab |
| Applications project                               |

## Grades

| Aspect         | Percent |
|----------------|---------|
| Midterm exam 1 | 20%     |
| Midterm exam 2 | 20%     |
| Homework       | 15%     |
| Projects       | 10%     |
| Final exam     | 35%     |

## Representative Textbooks and Other Course Materials

| Title                      | Author                |
|----------------------------|-----------------------|
| <i>Signals and Systems</i> | Oppenheim and Willsky |

## ABET-EAC Criterion 3 Outcomes

| Course Contribution |   | College Outcome                                                                         |
|---------------------|---|-----------------------------------------------------------------------------------------|
| ***                 | a | An ability to apply knowledge of mathematics, science, and engineering.                 |
| *                   | b | An ability to design and conduct experiments, as well as to analyze and interpret data. |
| *                   | c | An ability to design a system, component, or process to meet desired needs.             |

| Course Contribution |   | College Outcome                                                                                                   |
|---------------------|---|-------------------------------------------------------------------------------------------------------------------|
|                     | d | An ability to function on multi-disciplinary teams.                                                               |
| ***                 | e | An ability to identify, formulate, and solve engineering problems.                                                |
|                     | f | An understanding of professional and ethical responsibility.                                                      |
| *                   | g | An ability to communicate effectively.                                                                            |
|                     | h | The broad education necessary to understand the impact of engineering solutions in a global and societal context. |
|                     | i | A recognition of the need for, and an ability to engage in life-long learning.                                    |
|                     | j | A knowledge of contemporary issues.                                                                               |
| ***                 | k | An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.        |

### CpE ABET-EAC Criterion 9 Program Criteria Outcomes

| Course Contribution |   | Program Outcome                                                                                                                                                                                                                            |
|---------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ***                 | 1 | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics                                                                                                  |
| *                   | 2 | 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 | an ability to communicate effectively with a range of audiences                                                                                                                                                                            |
|                     | 4 | 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 | 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 | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions                                                                                                |
| ***                 | 7 | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies                                                                                                                                             |

### EE ABET-EAC Criterion 9 Program Criteria Outcomes

| Course Contribution |   | Program Outcome                                                                                                                                                                                                                            |
|---------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ***                 | 1 | an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics                                                                                                  |
| *                   | 2 | 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 | an ability to communicate effectively with a range of audiences                                                                                                                                                                            |
|                     | 4 | 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 | 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 | an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions                                                                                                |
| ***                 | 7 | an ability to acquire and apply new knowledge as needed, using appropriate learning strategies                                                                                                                                             |

### Additional Notes or Comments

Updated prereq to be consistent with university format.

Changed text from Fundamentals of Signals and Systems Using MATLAB, 3rd by Kamen and Heck 4/2/12

<ake consistent with OSU version 2/13/14

Added "or 292 or 294 (Spring 2011) " to prereqs 4/11/12

Added transfer courses to prereq 10/30/12

Added " ; or prereq or concurrent 2010 and permission of department." to prereqs 10/20/13

Update course description, add Math 2415 as rereq or conch, course goals expanded, course topics updated, make "projects" plural under grades. April 5, 2014 (result of ABET internal review)

Update prereqs to include new sophomore courses 9.11/15 BLA

Update prereqs again Update goals, topics, stars. 6/16/16 BLA

Edited text info, 5/10/17, CED

Update stars for new outcomes 6/5/ 2019 BLA

**Prepared by: Betty Lise Anderson**