

# ECE 5007: Communications Laboratory

## Course Description

A laboratory in digital data communication implementing a software-defined modem: quadrature modulation; phase-shift keyed modulation; inter-symbol interference; timing and frequency recovery.

**Prior Course Number:** 4007

**Transcript Abbreviation:** Comm Laboratory

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Undergrad, Graduate

**Student Ranks:** Junior, Senior, Masters, Doctoral

**Course Offerings:** Spring

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 7 Week

**Credits:** 0.5

**Repeatable:** No

**Time Distribution:** 3.0 hr Lab

**Expected out-of-class hours per week:** 0.0

**Graded Component:** Laboratory

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** Prereq or concur: 5000 (501), and enrollment in ECE or EngPhysics major; or Grad standing in ECE.

**Exclusions:** Not open to students with credit for 4007 or 508.

**Cross-Listings:**

**Course Rationale:** Course upgraded from 4007 to 5007 so that graduate students can take it, thereby helping with their graduate projects/theses.

**The course is required for this unit's degrees, majors, and/or minors:** No

**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:** Doctoral Course

## Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

## General Information

Class meeting pattern: seven three-hour laboratory sessions during second term; the second term offering allows students to be successful with the ECE5000 co-requisite, rather than prerequisite.

## Course Goals

Master concepts of sampling, aliasing, filtering, and quadrature modulation through implementation of software-defined modulation and demodulation.
Master signal space representation of digital modulation for phase-shift keying.
Be competent with timing and frequency recovery as examples of combating channel impairments.
Students should advance to competency their skills in creating structured software, debugging, and experimentation.
Students should demonstrate design competence via integration of processing steps to arrive at a working packet-based acoustic digital modem.

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Introduction: signals and systems			3.0					
Quadrature modulation			3.0					
Digital modulation			3.0					
Pulse shaping and inter-symbol interference			3.0					
Synchronization			3.0					
Frequency recovery			3.0					
Acoustic modem demonstration			3.0					

## Grades

Aspect	Percent
Laboratory reports	70%
Laboratory demonstrations	30%

## Representative Textbooks and Other Course Materials

Title	Author
<i>A Digital Communication Laboratory: Acoustic Explorations with a Software-Defined Modem (available via Carmen course page)</i>	L. Potter and Y. Yang
<i>Acoustic Transmitter App available at GooglePlay and iTunes.</i>	

## 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.
	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.

Course Contribution		College Outcome
*	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

Change from course number 4007.

Changed text. 3/25/15. CED

Update description, goals, topics, grading 6/16/16 BLA

Contributions to new outcomes. 6/5/19 BLA

Prepared by: Betty Lise Anderson