

# ECE 3010: Introduction to Radio Frequency and Optical Engineering

## Course Description

Waves and pulses on transmission lines; charges, fields, and potentials; inductance and capacitance; Faraday's law; Maxwell's Equations; plane wave propagation, polarization, reflection, and transmission.

**Prior Course Number:** 311, 312

**Transcript Abbreviation:** Intro RF Opt Eng

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Undergrad

**Student Ranks:** Junior

**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, 2021, 2100, 2100.02, 2100.06, or 2105; and Physics 1251 or 1261, or both 1240 and 1241; and Math 2415 or 2174; and enrollment in ECE or EngPhysics major; or prereq or concur: 2010 or 2061, and permission of department.

**Exclusions:** Not open to students with credit for 3010.01, 3010.02, 311, or 312.

**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

Become familiar with the theory and application of waves and pulses on transmission lines
Learn basic transmission line impedance matching concepts
Become familiar with the concepts of capacitance and inductance from a physical standpoint

Become familiar with the basic laws of time varying electromagnetic fields
Become familiar with the concepts of wave propagation, polarization, attenuation, reflection, and transmission

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Waves on transmission lines, including reflection and impedance on terminated transmission lines	9.0							
Impedance matching on transmission lines and use of Smith chart	5.0							
Pulses and transients on transmission lines	2.0							
Review of vector calculus using the theory of static fields as example	4.0							
Physical viewpoint on capacitance, resistance, Ohm's law, and inductance	8.0							
Faraday's law and applications	2.0							
Maxwell's equations, the wave equation and plane wave solutions	6.0							
Plane wave propagation, polarization, attenuation, reflection, and transmission	6.0							

## Representative Assignments

Homework.
Computer project.
Midterm exam.
Final Exam.

## Grades

Aspect	Percent
Homework	25%
Computer project	15%
Midterm exam	25%
Final exam	35%

## Representative Textbooks and Other Course Materials

Title	Author
<i>Fundamentals of Applied Electromagnetics</i>	F. Ulaby, E. Michielssen, and U. Ravaioli

## 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.

Course Contribution		College Outcome
**	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

Added two transition courses to exclusions.

Add 292 and 294 to prereqs. 4/11/12

add 2105 to prereqs and Physcis 1241and 1241 10?30?12

Added math 2175 to prereqs for students transferring in from other majors

Added " or prereq or concurrent 2010 or 2110, and permission of department.." to prereq  
10/20/13

Revise number of lecture per topic 4/21/14 BLA

Update prereqs to include 2020 and 2021. 9/4/15 BLA

Updated text info, 5/11/17, CED

Add "or" to sophomore prerequisites 8/8/17 BLA

Ne ABET Outceoms 6.14.2019 BLA

**Prepared by: Betty Lise Anderson**