

# ECE 5033: Surfaces and Interfaces of Electronic Materials

## Course Description

Provides the fundamental and practical basis for designing, processing, and characterizing the interfaces controlling the next generations of microelectronic and optoelectronic device structures.

**Prior Course Number:** 736

**Transcript Abbreviation:** Electron Interface

**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:** Odd Years

**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: 3030, and Physics 1250 or 1250H; or Grad standing in Engineering, Biological Science, or Math and Physical Sciences.

**Exclusions:** Not open to students with credit for 736.

**Cross-Listings:**

**Course Rationale:** Existing course.

**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

## Course Goals

Acquire a physical understanding of the fundamental electronic properties of semiconductor surfaces and interfaces
Learn to communicate in essay form the role of surfaces and interfaces in electrical engineering
Provide students with necessary background to understand the principle of new devices as new technologies develop

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Overview, motivation, and historical background	2.0							
Electrical measurements of semiconductor-metal contacts	1.0							
Interface states	2.0							
Ultrahigh vacuum technology	1.0							
Surface analysis: Electron, photon and ion spectroscopy overview	1.0							
Photoemission spectroscopy	3.0							
Particle-solid scattering: electrons, Auger electron spectroscopy, & electron energy loss spectroscopy	3.0							
Particle-solid scattering: ions, Rutherford backscattering spectrometry & secondary ion mass spectrometry	2.0							
Electron diffraction	1.0							
Scanned probe microscopy and spectroscopy	1.0							
Optical spectroscopies: modulation, ellipsometry, Raman, surface photovoltage, cathodoluminescence	4.0							
Electronic materials surfaces: growth, diffusion, etching, bonding, epitaxy	3.0							
Adsorbates on semiconductors	4.0							
Metals on semiconductors	5.0							
Semiconductor heterojunctions	5.0							
Future electronic interfaces & new directions	2.0							

## Representative Assignments

Midterm Essay
Final Term Paper
Extra credit homework problems (optional)

## Grades

Aspect	Percent
Midterm essay	40%
Final term paper	60%
Extra credit homework problems	0%

## Representative Textbooks and Other Course Materials

Title	Author
<i>An Essential Guide to Electronic Material Surfaces and Interfaces</i>	Leonard J. Brillson

## ABET-EAC Criterion 3 Outcomes

Course Contribution	College Outcome
***	a An ability to apply knowledge of mathematics, science, and engineering.

Course Contribution		College Outcome
	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.
*	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**

Update course description to match university version. Replacede Physics 1132 prereqi with 1250 or 1250H. Put exclusions in university form.

Updated text info, 5/10/17, CED

Added contributions to new ABET student outcomes per Sp19 review. 5/24/19 GJV

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