

# ECE 5127 (Approved): Power Electronics Lab

## Course Description

Laboratory introducing basic circuits of power electronics, and simulation and control hardware and software for various power and energy applications.

**Prior Course Number:** 628, 647

**Transcript Abbreviation:** Power Elec Lab

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Undergrad, Graduate

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

**Course Offerings:** Autumn

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 14 Week

**Credits:** 1.0

**Repeatable:** No

**Time Distribution:** 0.5 hr Lec, 2.5 hr Lab

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

**Graded Component:** Lecture

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** Prereq: 3040 (341) and enrollment in ECE major, or Grad standing in Engineering.

**Exclusions:** Not open to students with credit for 628 or 647.

**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

Introduce basic topologies of power switching circuits
Introduce fast switching characteristics of semiconductor devices
Introduce switching characteristics of passive elements, including capacitors and inductors, in solid state circuits
Introduce hardware and software used in power electronic switching circuits and power conditioning systems

Study and implementation of Pulse-Width-Modulation for power electronic converters
Investigate integration of power electronic converters with electric machines
Study and implementation of current regulation loop by Pulse-Width-Modulation for power electronic converters
Power electronics modeling, simulation and experimental verification

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Basic DC-DC power electronic circuits	1.5		1.5					
Switching characteristics of IGBTs, power MOSFETs and other devices; switching characteristics of capacitors; and induction in power switching circuits	2.0		4.0					
PWM method and implementation in DC-AC conversion	1.5		4.5					
Integration and interaction of power inverters and electric machines	1.0		5.0					
DSP-controlled PWM current regulation	1.0		5.0					
Modeling and computer simulation of power electronic converters	1.5		4.5					
Experimental verification of power electronic modeling	1.5		4.5					
Hardware-in-the-loop and DSP applications in power electronics	0.5		2.5					

## Representative Assignments

Off-line (i.e., pre-lab) design and computer simulation of power electronic inverters
Perform various experiments related to power electronic control of DC-DC, DC-AC, PWM algorithms. Report computer simulation and experimental results. Discuss agreement and discrepancy, and make conclusions.

## Grades

Aspect	Percent
Mid semester Exam	25%
Final Exam	25%
Laboratory reports including participation; also includes any pre-lab modeling/simulation assignments.	50%

## Representative Textbooks and Other Course Materials

Title	Author
<i>Class notes and lab manual</i>	provided by department

## 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.

Course Contribution		College Outcome
	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.

### Additional Notes or Comments

updated abbrev, prereqs, exclusions, course goals and topics to match university version.

added grad standing to prereqs 6/7/12

clarified prereq 6/8/12

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