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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CpE</td>
<td>Computer Engineering</td>
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<tr>
<td>EE</td>
<td>Electrical Engineering</td>
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Course Goals

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<tr>
<th>Description</th>
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<tbody>
<tr>
<td>Introduce basic topologies of power switching circuits</td>
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<td>Introduce fast switching characteristics of semiconductor devices</td>
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<tr>
<td>Introduce switching characteristics of passive elements, including capacitors and inductors, in solid state circuits</td>
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<tr>
<td>Introduce hardware and software used in power electronic switching circuits and power conditioning systems</td>
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Course Topics

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

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Mid semester Exam</td>
<td>25%</td>
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<td>Final Exam</td>
<td>25%</td>
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<td>Laboratory reports including participation; also includes any</td>
<td>50%</td>
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<tr>
<td>pre-lab modeling/simulation assignments.</td>
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Representative Textbooks and Other Course Materials

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
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<tbody>
<tr>
<td>Class notes and lab manual</td>
<td>provided by department</td>
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ABET-EAC Criterion 3 Outcomes

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<thead>
<tr>
<th>Course Contribution</th>
<th>College Outcome</th>
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<tr>
<td>**</td>
<td>a An ability to apply knowledge of mathematics, science, and engineering.</td>
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<td>***</td>
<td>b An ability to design and conduct experiments, as well as to analyze and interpret data.</td>
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<td>c An ability to design a system, component, or process to meet desired needs.</td>
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<td>d An ability to function on multi-disciplinary teams.</td>
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<td>**</td>
<td>e An ability to identify, formulate, and solve engineering problems.</td>
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<tr>
<td>Course Contribution</td>
<td>College Outcome</td>
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<tr>
<td>f</td>
<td>An understanding of professional and ethical responsibility.</td>
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<td>*</td>
<td>An ability to communicate effectively.</td>
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<td>*</td>
<td>The broad education necessary to understand the impact of engineering solutions in a global and societal context.</td>
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<tr>
<td>i</td>
<td>A recognition of the need for, and an ability to engage in life-long learning.</td>
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<tr>
<td>*</td>
<td>A knowledge of contemporary issues.</td>
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<tr>
<td>**</td>
<td>An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
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**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

**Prepared by:** Betty Lise Anderson