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## **AC 2012-5554: AN OVERVIEW OF EXISTING POWER ELECTRONICS COURSES**

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# **An Overview of Existing Power Electronics Courses Offered at Universities in the United States**

**Abstract:** This paper presents the current number and location of academic programs offering courses in Power Electronics at universities in the United States of America. A survey of Electrical Engineering (EE) and Electrical Engineering Technology (EET) programs has been done to determine the US universities that are offering courses of Power Electronics with or without laboratory/practicum content, within their respective EE and/or EET programs.

Data was collected from each university's on-line catalog, and has been analyzed to evaluate the extent of practicum/laboratory experience gained by EE and EET students in the respective US universities. Previous research has determined that the practicum/laboratory experience is instrumental in the graduates' professional development, and it is one of the main criteria used by employers to hire graduates from EE and/or EET programs. Consequently, laboratory content in a Power Electronics course is directly related, and reflects the state of current focus of EE and EET programs in the United States of America.

Thus, there is an implicit perception in the industry that graduates from EE and EET programs with no laboratory/practicum component on the power electronics course are less competitive as compared to graduates where the laboratory/practicum is already implemented. This research demonstrates the need of practicum/laboratory for power electronics courses and, consequently the future available professionals that will support the transition of current US economy to an economy focused on renewable energy.

## Introduction

Electrical Engineering discipline has been initially concerned with the theory and applications of generating and transmitting/delivering electric power. Due to advances in telecommunication and energy conversion, the field of power electronics has emerged. Power electronics applications range from milliwatt to megawatt power conversion, in both stationary and mobile applications.

Proper training of electrical engineers should include elements of power electronics; power diodes, TRIACs, DIACs, SCRs, to mention just a few. Any industrial setting consists of power electronics working in concert with embedded systems. Thus, an ideal electrical engineering program would include at least one course of power electronics, with a practicum/laboratory element that complements the theoretical knowledge. Many universities in the United States have already adopted this strategy, placing themselves as front runners for less traditional engineering areas like mechatronics and renewable energy.

## Survey purpose

With the increasing implementation of academic programs in newer fields of engineering, i.e., renewable energy engineering, mechatronics, aerospace engineering, power systems engineering, where energy conversion concepts are the foundation of those programs, emphasis on power electronics requires an in-depth knowledge and skills, which can only be acquired through a balanced lecture-lab combination. While courses of power electronics have been an integral component of electrical engineering and/or engineering technology programs, the lecture & project scheme has been the dominant method of course material delivery. Thus, it is uncertain to determine what practical skills were acquired, through any power electronics course that does not include a formal laboratory component.

## Previous research

Previous research has determined that the practicum/laboratory experience is instrumental in the graduates' professional development, and it is one of the main criteria used by employers to hire graduates from EE and/or EET programs.

The engineering profession is defined in terms of its function, to solve problems by manipulating material, energy, and information, for the benefit of the humankind. Thus, engineers must have the knowledge of natural sciences and be able to employ specific tools to analyze, design, and construct complex systems. In general, engineering education implies a method of teaching that is both theoretical, concentrated on the scientific principles, and practical, through laboratory experiment. During its evolution, engineering education has overlooked the importance of laboratory activities, emphasizing the more theoretical work. Latest developments in inexpensive computing power and internet communication, with the increasing number of online academic programs, have prompted the need of laboratory teaching.<sup>1</sup>

Laboratory teaching is the primary method of developing skills and competencies for engineering and/or engineering technology students, ensuring a close fit for the industry requirements. The set of skills and knowledge acquired by an engineering graduate has to meet the industry requirements of a global economy. Thus, the laboratory has become an essential component in all engineering programs.<sup>2</sup>

To determine if the set of skills and competencies required by the industry are properly addressed, an assessment plan is generally adopted by engineering/engineering technology departments, where the "industry need" is a main component, as exemplified by the ABET learning outcomes:<sup>3</sup>

An engineering technology program must demonstrate that graduates have:

- a. An appropriate mastery of the knowledge, techniques, skills and tools of their disciplines
- b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology
- c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
- d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives
- e. An ability to function effectively on teams
- f. An ability to identify, analyze and solve technical problems

- g. An ability to communicate effectively in writing
- h. An ability to communicate orally
- i. A recognition of the need for, and an ability to engage in lifelong learning
- j. An ability to understand professional, societal and global issues
- k. A respect for diversity and a knowledge of contemporary professional, societal and global issues
- l. A commitment to quality, timeliness, and continuous improvement
- m. An ability to program computers an/or utilize computer applications effectively
- n. An ability to use modern laboratory techniques, skills, and/or equipment effectively

Some studies suggest that electronic lab simulation leads to similar learning outcomes as compared to experimental/physical lab teaching<sup>4</sup> while other studies have concluded that practicum or projects elevate student interest. Therefore, increasing students' activity in the lab, through teamwork and use of practical projects should be an engineering education priority.<sup>5</sup> Of notable initiative, at Eastern Washington University, laboratory-oriented training is emphasized in the electrical engineering program, without straying from the theoretical teaching component. With the intensive use of industry-supplied problems, laboratory teaching is thorough and comprehensive.<sup>6</sup>

### Constraints

It was assumed that power electronics course description was accurately presented in the on-line academic catalog. Implicitly, the information contained in each academic catalog is assumed to be complete and up to date.

Since all information regarding the engineering/engineering technology curriculum, for each engineering/engineering technology program, was retrieved from the publically posted academic catalog, the accurate course description and structured (i.e., lab/practicum, project) is implied. Any eventual inaccuracies were inadvertently reproduced.

The present paper scope is limited to the examination of power electronics courses, delivered as lecture only or as lecture-lab combination, offered at universities in the United States. Course effectiveness analysis, for any academic unit, is not covered in this paper.

### Data Collected

All relevant information related to course content and delivery format (lecture or lecture-lab combination) was accessed through each university's web site and its on-line catalog, particular to each state, using the list provided through the link <http://univsource.com> (for each state, i.e., <http://univsource/ar.com>, for the state of Arkansas).

While the organization of course listing varies among universities within individual states, the course descriptions are generally similar and available in either html or PDF format. Data collected from the search was compiled for each state, with the respective tables presented in the Appendix section.

**Alabama:** Four (4) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Three (3) are public universities and one (1) is a private university. Only one (1) EE program offers practicum/laboratory training in conjunction with the Power electronics course.

**Alaska:** One (1) university is offering an Electrical Engineering program with courses of Power Electronics, at the graduate and undergraduate levels, at a public university. No practicum/laboratory training is associated with the Power Electronics courses.

**Arizona:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. Two (2) are public universities and one (1) is a private university. No practicum/laboratory training is associated with any of the Power Electronics courses offered.

**Arkansas:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. All three (3) are public universities. No practicum/laboratory training is associated with any of the Power Electronics courses offered.

**California:** Ten (10) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Nine (9) are public universities and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at the private university and six (6) of the public universities.

**Colorado:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. All three (3) are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at only one (1) university at the undergraduate level.

**Connecticut:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. Two (2) are private universities and one (1) is a public university. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) universities, one public and one private.

**Delaware:** One (1) university is offering an Electrical Engineering program with courses of Power Electronics at the undergraduate level. It is a public university. No practicum/laboratory training is associated with the Power Electronics courses offered.

**Florida:** Five (5) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Four (4) are public universities and one (1) is a private university. No practicum/laboratory training is associated with any of the Power Electronics courses offered.

**Georgia:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. Two (2) are public universities and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at the two public universities.

**Hawaii:** There is no record indicating any Electrical Engineering program offering a course of Power Electronics at any university.

**Idaho:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. All three (3) are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) universities.

**Illinois:** Five (5) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Four (4) are public universities and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at three (3) universities, two (2) public and one (1) private.

**Indiana:** Five (5) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Three (3) are public universities and two (2) are private university. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) universities, one (1) public and one (1) private.

**Iowa:** One (1) university is offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. It is a public university with no practicum/laboratory training is associated with the Power Electronics courses offered.

**Kansas:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Both are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at one (1) university.

**Kentucky:** One (1) university is offering Electrical Engineering program with courses of Power Electronics at the undergraduate level. It is a public university, with no practicum/laboratory training associated with the Power Electronics courses.

**Louisiana:** Four (4) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. All four are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at one (1) university.

**Maine:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Both are public universities. Practicum/laboratory training associated with the Power Electronics courses is not offered at any university in this state.

**Maryland:** Five (5) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level only. Four (4) are public universities and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) universities (one public, the other one private) in this state.

**Massachusetts:** Six (6) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Two (2) are public universities and four (4) are private universities. Practicum/laboratory training associated with the Power Electronics courses is offered at three (3) private universities in this state.

**Michigan:** Eight (8) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Seven (7) are public universities, and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at four (4) public universities and one (1) private university.

**Minnesota:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level only. Both are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at one (1) university in this state.

**Mississippi:** There is no record indicating any Electrical Engineering program offering a course of Power Electronics at any university in this state.

**Missouri:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. All three (3) are public universities, offering practicum/laboratory training associated with the Power Electronics courses.

**Montana:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Both are public universities, offering practicum/laboratory training associated with the Power Electronics courses.

**Nebraska:** One (1) public university is offering an Electrical Engineering program with courses of Power Electronics at the undergraduate level only. No practicum/laboratory training associated with the Power Electronics courses is offered.

**Nevada:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Both are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at one (1) university in this state.

**New Hampshire:** One (1) private university is offering an Electrical Engineering program with courses of Power Electronics at the graduate level only. Practicum/laboratory training associated with the Power Electronics courses is offered at this private university.

**New Jersey:** Two (2) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Both are public universities. No practicum/laboratory training associated with the Power Electronics courses is offered.

**New Mexico:** One (1) public university is offering an Electrical Engineering program with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is offered at this one (1) university.

**New York:** Eight (8) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Five (5) are public universities, and three (3) are private universities. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) public universities in this state.

**North Carolina:** Three (3) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is not offered at any university in this state.

**North Dakota:** Two (2) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is not offered at any university in this state.

**Ohio:** Seven (7) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Six (6) are public universities, and one (1) is a private university. Practicum/laboratory training associated with the Power Electronics courses is offered at five (5) public universities in this state.

**Oklahoma:** One (1) public university is offering an Electrical Engineering program with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is not offered.

**Oregon:** Two (2) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is **offered** at both universities.

**Pennsylvania:** Eight (8) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Two (2) are public universities, and six (6) are private universities. Practicum/laboratory training associated with the Power Electronics courses is **offered** at one (1) public university and five (5) private universities.

**Rhode Island:** There is no record indicating any Electrical Engineering program offering a course of Power Electronics at any university.

**South Carolina:** One (1) public university is offering an Electrical Engineering program with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is **not offered**.



**South Dakota:** One (1) public university is offering an Electrical Engineering program with courses of Power Electronics at the undergraduate level only, **offering practicum/laboratory** training associated with the Power Electronics course.

**Tennessee:** Four (4) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. All four are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at one (1) university.

**Texas:** Eleven (11) universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Ten are public universities, and one is a private institution. Practicum/laboratory training associated with the Power Electronics courses is **offered** at six (6) universities.

**Utah:** There were no records indicating any Electrical Engineering program offering courses of Power Electronics at any university in this state.

**Virginia:** Three (3) universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate level. All three (3) are public universities. Practicum/laboratory training associated with the Power Electronics courses is offered at two (2) universities.

**Vermont:** There were no records indicating any Electrical Engineering program offering courses of Power Electronics at any university in this state.

**Washington:** Three (3) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is **offered** at one university.

**Wisconsin:** Two (2) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is **offered** at one university.

**West Virginia:** Two (2) public universities are offering Electrical Engineering programs with courses of Power Electronics at the graduate and undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is not offered at either university.

**Wyoming:** One (1) public university is offering Electrical Engineering program with one course of Power Electronics at the undergraduate levels. Practicum/laboratory training associated with the Power Electronics courses is not offered.

**District of Columbia:** Two (2) private universities are offering Electrical Engineering programs with courses of Power Electronics at the undergraduate and graduate level respectively. Practicum/laboratory training associated with the Power Electronics courses is not offered at either university.

## Data Analysis

Recent data shows that the majority of Electrical Engineering programs, that include courses of power electronics, do not have practicum/laboratory associated with those courses in their respective curricula. However, all Engineering Technology programs have one or more sections of practicum/laboratory associated with their respective power electronics courses, thus a better implementation of complex theory is achieved. From the entire list of universities surveyed in the U.S., 143 universities are offering at least one course in power electronics in their EE and/or EET curriculum, and only 66 universities offer practicum/laboratory components associated with the lecture sessions. Thus 46.15% U.S. universities, from the total pool of universities with EE and/or EET curriculum, are offering laboratory-oriented course in power electronics, as compared with traditional electronics courses (known as Electronics-I and Electronics-II) that have always associated practicum/laboratory with either each course or with the combination of the two courses.

From a total of 28 private universities offering courses of power electronics in their respective EE and/or EET program, 16 private universities are offering power electronics courses with practicum/laboratory component, while 12 private universities offer power electronics lecture only. This translates to 57.14% private universities offering lecture & lab courses, versus 42.86% private universities offering lecture only, slightly better than the general trend.

As compared with the private universities, U.S. public universities offering power electronics courses, as lecture & lab combination, represent only 34.96% of the total number of universities offering EE and/or EET programs, with 50 universities offering lecture & lab for power electronics courses. The ratio of public universities offering lecture & lab courses of power electronics is 43.47%, compared to the U.S. public universities only (115 public universities).

## Conclusion

In the near future, the ratio of universities offering power electronics courses as lecture & lab combination should improve, as the industry needs for field engineers has steadily increase, with focus on applications in renewable energy and vehicular systems. There is the implicit expectation the industry has from the engineering graduate to be effective from the first week of employment, with little to no training provided. Thus, academia bears increased responsibility regarding professional competencies of engineering graduates.

This study will be the foundation for the design and development of multi-functional laboratory equipment, designed to accommodate most experiments associated with topics covered in courses of power electronics. The power electronics lab equipment will be employed as a supplement instructional aid, providing the students and instructors with a unique work-bench for power electronic topics, exhibiting the required flexibility and safety for a large spectrum of laboratory experiments. The power electronics equipment would exhibit the required flexibility and safety for a large spectrum of laboratory experiments, and will include features that would accommodate interfacing with embedded systems.

## References

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## Appendix

State	University name	Type	Accreditation	Course(s)	Lab
AL	Auburn University	public	EAC-ABET	ELEC 5610	none
AL	Tuskegee University	<i>private</i>	EAC-ABET	EEN 0587	none
AL	University of Alabama	public	EAC-ABET	ECE 551	<b>ECE 552</b>
AL	University of South Alabama	public	EAC-ABET	EE486/586	none

Table 1: Universities in the State of Alabama

State	University name	Type	Accreditation	Course(s)	Lab
AK	University of Alaska-Fairbanks	public	EAC-ABET	EE 408/608	none

Table 2: Universities in the State of Alaska

State	University name	Type	Accreditation	Course(s)	Lab
AZ	Arizona State University	public	EAC-ABET	EEE 360/472	none
AZ	Embry-Riddle Aeronautical University	<i>private</i>	EAC-ABET	EE 450	none
AZ	University of Arizona	public	EAC-ABET	ECE 561	none

Table 3: Universities in the State of Arizona

State	University name	Type	Accreditation	Course(s)	Lab
AR	Arkansas State University	public	EAC-ABET	EE 4723	none
AR	Arkansas Tech University	public	EAC-ABET	EE 6103	none
AR	University of Arkansas-Fayetteville	public	EAC-ABET	ELEG 4323/5533	none

Table 4: Universities in the State of Arkansas

State	University name	Type	Accreditation	Course(s)	Lab
CA	California Polytechnic State University	public	EAC-ABET	EE 410 EE 411	<b>EE 410L</b> <b>EE 411L</b>
CA	California State Polytechnic University	public	EAC-ABET	ECE 469	<b>ECE 469L</b>
CA	California State University-Fresno	public	EAC-ABET	ECE 153	none
CA	California State University-Long Beach	public	EAC-ABET	EE 550	none
CA	California State University-Los Angeles	public	EAC-ABET	EE 483 EE 573	<b>EE 483L</b> <b>EE 573L</b>
CA	California State University-Sacramento	public	EAC-ABET	EEE 146 EEE148	<b>EEE 146L</b> <b>EEE 148L</b>
CA	DeVry University-Fremont	<i>private</i>	TAC-ABET	Power Electronics	<b>Power Elec. Lab</b>
CA	San Diego State University	public	EAC-ABET	EE 484	none
CA	San Francisco State University	public	EAC-ABET	ENGR 455	<b>ENGR 455L</b>
CA	University of California-Irvine	public	EAC-ABET	EECS 166A	<b>EECS 166L</b>

Table 5: Universities in the State of California

State	University name	Type	Accreditation	Course(s)	Lab
CO	Colorado State University	public	EAC-ABET	ECE 562 ECE 563	none
CO	Colorado School of Mines	public	EAC-ABET	EEGN 485	none
CO	University of Colorado-Boulder	public	EAC-ABET	ECEN 4517	<b>ECEN 4517L</b>

Table 6: Universities in the State of Colorado

State	University name	Type	Accreditation	Course(s)	Lab
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CT	University of Connecticut	public	EAC-ABET	ECE 3211	<b>ECE 3211L</b>
CT	University of Hartford	<i>private</i>	EAC-ABET	ECE 573	none
CT	University of New Haven	<i>private</i>	EAC-ABET	EE 440	<b>EE 441</b>

Table 7: Universities in the State of Connecticut

State	University name	Type	Accreditation	Course(s)	Lab
DE	University of Delaware	public	EAC-ABET	ELEG 429	none

Table 8: Universities in the State of Delaware

State	University name	Type	Accreditation	Course(s)	Lab
FL	Florida A&M University	public	EAC-ABET	EEL 4243	none
FL	Florida International University	public	EAC-ABET	ECE 4241	none
FL	University of Florida	public	EAC-ABET	EEL 4242	none
FL	University of Miami	<i>private</i>	EAC-ABET	EEN 552	none
FL	University of West Florida	public	EAC-ABET	EEL 4242	none

Table 9: Universities in the State of Florida

State	University name	Type	Accreditation	Course(s)	Lab
GA	Georgia Institute of Technology	public	EAC-ABET	ECE 4330 ECE 6330	<b>ECE 4331</b> <b>ECE 6331</b>
GA	Mercer University	<i>private</i>	EAC-ABET	ECE 411	none
GA	Southern Polytechnic State University	public	TAC-ABET	ECET 4540	<b>ECET 4540L</b>

Table 10: Universities in the State of Georgia

State	University name	Type	Accreditation	Course(s)	Lab
ID	Boise State University	public	EAC-ABET	ECE 472	<b>ECE 472L</b>
ID	Idaho State University	public	EAC-ABET	EE 4482	none
ID	University of Idaho	public	EAC-ABET	ECE 427	<b>ECE 425</b>

Table 11: Universities in the State of Idaho

State	University name	Type	Accreditation	Course(s)	Lab
IL	Illinois Institute of Technology	<i>private</i>	EAC-ABET	ECE 411	<b>ECE 411L</b>

IL	Northern Illinois University	public	EAC-ABET	ELE 440	none
IL	Southern Illinois University- Carbondale	public	EAC-ABET	ECE 483	none
IL	University of Illinois- Chicago	public	EAC-ABET	ECE 445 ECE545	<b>ECE 445L</b> <b>ECE 545L</b>
IL	University of Illinois- Urbana-Champaign	public	EAC-ABET	ECE 464 ECE 469	<b>ECE 464L</b> <b>ECE 469L</b>

Table 12: Universities in the State of Illinois

State	University name	Type	Accreditation	Course(s)	Lab
IN	Indiana Institute of Technology	public	EAC-ABET	EE 4200	none
IN	Indiana University- Indianapolis	public	EAC-ABET	ECE 42700	none
IN	Indiana University-Forth Wayne	public	EAC-ABET	ECET 31200	<b>ECET 31200L</b>
IN	Purdue University-West Lafayette	public	EAC-ABET	ECE 42700 ECE 43300	none
IN	Rose-Hulman Institute of Technology	<i>private</i>	EAC-ABET	ECE 452 ECE 556	<b>ECE 452L</b> <b>ECE 556L</b>

Table 13: Universities in the State of Indiana

State	University name	Type	Accreditation	Course(s)	Lab
IA	Iowa State University	public	EAC-ABET	EE 556	none

Table 14: Universities in the State of Iowa

State	University name	Type	Accreditation	Course(s)	Lab
KS	Kansas State University	public	EAC-ABET	ECE 624	none
KS	Wichita State University	public	EAC-ABET	EE 688	<b>EE 688L</b>

Table 15: Universities in the State of Kansas

State	University name	Type	Accreditation	Course(s)	Lab
KY	University of Kentucky	public	EAC-ABET	EE 603 EE 604	none

Table 16: Universities in the State of Kentucky

State	University name	Type	Accreditation	Course(s)	Lab
LA	Louisiana State University	public	EAC-ABET	EE 4460 EE4490	<b>EE 4460L</b> <b>EE 4490L</b>
LA	Louisiana Tech University	public	EAC-ABET	ELEN 582	none
LA	McNeese State University	public	EAC-ABET	ELEN 441 ELEN 541	none
LA	University of New Orleans	public	EAC-ABET	ENEE 4544	none

Table 17: Universities in the State of Louisiana

State	University name	Type	Accreditation	Course(s)	Lab
ME	Maine Maritime Academy	public	TAC-ABET	ET 432	none
ME	University of Southern Maine	public	EAC-ABET	ELE 412	none

Table 18: Universities in the State of Maine

State	University name	Type	Accreditation	Course(s)	Lab
MD	Capitol College	<i>private</i>	EAC-ABET	EE 300	<b>EE 300L</b>
MD	Frostburg State University	public	EAC-ABET	ENEE	N/A
MD	United States Naval Academy	public	EAC-ABET	EE 344	<b>EE 344L</b>
MD	University of Maryland	public	EAC-ABET	ENEE 475	none
MD	University of Maryland- Eastern Shore	public	EAC-ABET	ENEE 385	none

Table 19: Universities in the State of Maryland

State	University name	Type	Accreditation	Course(s)	Lab
MA	Massachusetts Institute of Technology	<i>private</i>	N/A	EECS 6.334	<b>EECS 6.131</b>
MA	Northeastern University	<i>private</i>	EAC-ABET	EECE 5684	<b>EECE 5684L</b>
MA	University of Massachusetts- Dartmouth	public	EAC-ABET	ECE 442	none
MA	University of Massachusetts- Lowell	public	EAC-ABET	16.473	none
MA	Western New England College	public	EAC-ABET	EE 434	none
MA	Worcester Polytechnic Institute	<i>private</i>	EAC-ABET	ECE 3503	<b>ECE 3503L</b>

Table 20: Universities in the State of Massachusetts

State	University name	Type	Accreditation	Course(s)	Lab
MI	Grand Valley State University	public	EAC-ABET	EGR 655	none
MI	Kettering University	<i>private</i>	EAC-ABET	EE 322 EE 424	<b>EE 322L</b> <b>EE 424L</b>
MI	Michigan State University	public	EAC-ABET	ECE 320 ECE821	none
MI	Saginaw Valley State University	public	EAC-ABET	ECE 341	<b>ECE 341L</b>
MI	University of Michigan-Ann Arbor	public	EAC-ABET	EECS 418	none
MI	University of Michigan-Dearborn	public	EAC-ABET	ECE 415 ECE 517	<b>ECE 415L</b> <b>ECE 517L</b>
MI	Wayne State University	public	EAC-ABET	ECE 5410	<b>ECE 5410L</b>
MI	Western Michigan University	public	EAC-ABET	ECE 4200 ECE 5200	<b>ECE 4200L</b> <b>ECE5200L</b>

Table 21: Universities in the State of Michigan

State	University name	Type	Accreditation	Course(s)	Lab
MN	University of Minnesota-Duluth	public	EAC-ABET	ECE 5522	none
MN	University of Minnesota-Twin cities	public	EAC-ABET	EE 4741	<b>EE 4743</b>

Table 22: Universities in the State of Minnesota

State	University name	Type	Accreditation	Course(s)	Lab
MO	Missouri University of Science & Technology	public	EAC-ABET	EI Eng 353	<b>EI Eng 354</b>
MO	University of Missouri-Columbia	public	EAC-ABET	ECE 4410 ECE 8410 ECE 8420	<b>ECE 4410L</b>
MO	University of Missouri-Kansas City	public	EAC-ABET	ENGR 436 ENGR 536	<b>ENGR 436L</b>

Table 23: Universities in the State of Missouri

State	University name	Type	Accreditation	Course(s)	Lab
MT	Montana State University-Bozeman	public	EAC-ABET	ECE 451 ECE 556	<b>ECE 451L</b>



MT	Montana Tech-University of Montana	public	EAC-ABET	EE 4520	<b>EE 4520L</b>
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Table 24: Universities in the State of Montana

State	University name	Type	Accreditation	Course(s)	Lab
NB	University of Nebraska	public	EAC-ABET	ELEC 428 ELEC 828	none

Table 25: Universities in the State of Nebraska

State	University name	Type	Accreditation	Course(s)	Lab
NV	University of Nevada-Las Vegas	public	EAC-ABET	EE 442 EE 642	none
NV	University of Nevada-Reno	public	EAC-ABET	EE442 EE 642 EE 764	<b>EE 764L</b>

Table 26: Universities in the State of Nevada

State	University name	Type	Accreditation	Course(s)	Lab
NH	Dartmouth College	<i>private</i>	EAC-ABET	ENGS 125	<b>ENGS 125L</b>

Table 27: Universities in the State of New Hampshire

State	University name	Type	Accreditation	Course(s)	Lab
NJ	New Jersey Institute of Technology	public	EAC-ABET	ECE 441 ECE 616	none
NJ	Rutgers University	public	EAC-ABET	14:332:460	none

Table 28: Universities in the State of New Jersey

State	University name	Type	Accreditation	Course(s)	Lab
NM	New Mexico State University	public	EAC-ABET	EE 432 EE 537	<b>EE 432L</b> <b>EE 537L</b>

Table 29: Universities in the State of New Mexico

State	University name	Type	Accreditation	Course(s)	Lab
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NY	Alfred State College	public	TAC-ABET	ELET 6224	none
NY	Binghamton University	public	EAC-ABET	EECE 419 ECE 504 ECE 421	none
NY	Cornell University	<i>private</i>	EAC-ABET	ECE 5340	none
NY	Polytechnic University	<i>private</i>	EAC-ABET	EL 5673 EL6603	none
NY	Rochester Institute of Technology	<i>private</i>	EAC-ABET	0301-646	none
NY	State University of New York-Canton	public	TAC-ABET	ELEC 332	<b>ELEC 332L</b>
NY	State University of New York-New Palz	public	EAC-ABET	EGE 580	none
NY	University at Buffalo	public	EAC-ABET	EE 567	<b>EE 582</b>

Table 30: Universities in the State of New York

State	University name	Type	Accreditation	Course(s)	Lab
NC	North Carolina A&T State University	public	EAC-ABET	ELEN 610	none
NC	North Carolina State University	public	EAC-ABET	ECE 534	none
NC	University of North Carolina-Charlotte	public	EAC-ABET	ECGR 3134 ELET 4142	none

Table 31: Universities in the State of North Carolina

State	University name	Type	Accreditation	Course(s)	Lab
ND	North Dakota State University	public	EAC-ABET	ECE 437 ECE 637	none
ND	University of North Dakota	public	EAC-ABET	EE 401	none

Table 32: Universities in the State of North Dakota

State	University name	Type	Accreditation	Course(s)	Lab
OH	Bryant & Stratton College	<i>private</i>	TAC-ABET	ELET 442	none
OH	Cleveland State University	public	TAC-ABET	EEC 470 EEC474 EEC574 EEC673 EEC773 EET 410	<b>EEC 471</b> <b>EET 411</b>
OH	Ohio State University	public	EAC-ABET	ECE 624	none

				ECE 724 ECE 844	
OH	University of Akron	public	EAC-ABET	EE 483 EE 583	<b>EE 484</b> <b>EE 584</b>
OH	University of Toledo	public	EAC-ABET	EECS 5480 EECS 7480	<b>EECS 5490</b> <b>EECS 7490</b>
OH	Youngstown State University	public	EAC-ABET	ECEN 5890	<b>ECEN</b> <b>5890L</b>

Table 33: Universities in the State of Ohio

State	University name	Type	Accreditation	Course(s)	Lab
OK	Oklahoma State University	public	EAC-ABET	ECE 4133 ECE 5353	none

Table 34: Universities in the State of Oklahoma

State	University name	Type	Accreditation	Course(s)	Lab
OR	Oregon Institute of Technology	public	EAC-ABET	EE 419	<b>EE 419L</b>
OR	Oregon State University	public	EAC-ABET	ECE 431	<b>ECE 431L</b>
OR	Portland State University	public	EAC-ABET	ECE 445 ECE 545	<b>ECE 446</b> <b>ECE 546</b>

Table 35: Universities in the State of Oregon

State	University name	Type	Accreditation	Course(s)	Lab
PA	Bucknell University	<i>private</i>	EAC-ABET	ELEC 452	<b>ELEC</b> <b>452L</b>
PA	Carnegie Mellon University	<i>private</i>	EAC-ABET	18-418	<b>18-418L</b>
PA	Drexel University	<i>private</i>	EAC-ABET	ECEP 451 ECEP 452 ECEP 453	<b>ECEP 451L</b> <b>ECEP 452L</b> <b>ECEP 453L</b>
PA	Gannon University	<i>private</i>	EAC-ABET	ECE 467	<b>ECE 467L</b>
PA	Pennsylvania State University	public	TAC-ABET	EE 413 EET 423	<b>EET 423L</b>
PA	University of Pittsburgh	public	EAC-ABET	ECE 2250	none
PA	Wilkes University	<i>private</i>	EAC-ABET	EE 325	none
PA	York College	<i>private</i>	EAC-ABET	ECE 410	<b>ECE 410L</b>

Table 36: Universities in the State of Pennsylvania

State	University name	Type	Accreditation	Course(s)	Lab
SC	University of South Carolina-Columbia	public	EAC-ABET	ELCT 572 ELCT 772	none

Table 37: Universities in the State of South Carolina

State	University name	Type	Accreditation	Course(s)	Lab
SD	South Dakota School of Mines & Technology	public	EAC-ABET	EE 432	<b>EE 432L</b>

Table 38: Universities in the State of South Dakota

State	University name	Type	Accreditation	Course(s)	Lab
TN	Tennessee State University	public	EAC-ABET	EECE 3330	none
TN	Tennessee Technological University	public	EAC-ABET	ECE 4630 ECE 5630	none
TN	University of Tennessee	public	EAC-ABET	ECE 481 ECE 482 ECE 523 ECE 623	none
TN	Vanderbilt University	<i>private</i>	EAC-ABET	EECE 266	<b>EECE 266L</b>

Table 39: Universities in the State of Tennessee

State	University name	Type	Accreditation	Course(s)	Lab
TX	Prairie View A&M University	public	EAC-ABET	ELEG 4243	none
TX	Rice University	<i>private</i>	EAC-ABET	ELEC 443	<b>ELEC 443L</b>
TX	Texas A&M University	public	EAC-ABET	ECEN 438 ECEN 441	<b>ECEN 438L</b> <b>ECEN 441L</b>
TX	Texas Tech University	public	EAC-ABET	ECE 4316	none
TX	University of Houston	public	TAC-ABET	ECE 5380 ELET 4326	<b>ELET 4126</b>
TX	University of Texas-Arlington	public	EAC-ABET	EE 6375	none
TX	University of Texas-Austin	public	EAC-ABET		<b>EE 462L</b>
TX	University of Texas-Brownsville	public	TAC-ABET	ELET 3424	<b>ELET 3424L</b>
TX	University of Texas-El Paso	public	EAC-ABET	EE 4352	none

TX	University of Texas-Tyler	public	EAC-ABET	EENG 4317	none
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Table 40: Universities in the State of Texas

State	University name	Type	Accreditation	Course(s)	Lab
VA	Old Dominion University	public	EAC-ABET	ECE 403 ECE 503 ECE 404 ECE 504	none
VA	Virginia Military Institute	public	EAC-ABET	ECE 4224 ECE 5244	<b>ECE 4284</b> <b>ECE 5260</b>
VA	Virginia Tech	public	EAC-ABET	ECE 4224 ECE5244	<b>ECE 4284</b> <b>ECE 5260</b>

Table 41: Universities in the State of Virginia

State	University name	Type	Accreditation	Course(s)	Lab
WA	Seattle University	public	EAC-ABET	ECEGR 424	none
WA	University of Washington	public	EAC-ABET	ECE 452	<b>ECE 452L</b>
WA	Washington State University	public	EAC-ABET	ECE 486	none

Table 42: Universities in the State of Washington

State	University name	Type	Accreditation	Course(s)	Lab
WI	University of Wisconsin-Madison	public	EAC-ABET	ECE 412	<b>ECE 512</b>
WI	University of Wisconsin-Milwaukee	public	EAC-ABET	ElecEng 572	none

Table 43: Universities in the State of Wisconsin

State	University name	Type	Accreditation	Course(s)	Lab
WV	West Virginia University	public	EAC-ABET	EE 435 EE 537	none
WV	West Virginia University Institute of Technology	public	TAC-ABET	EE 435	none

Table 44: Universities in the State of West Virginia

State	University name	Type	Accreditation	Course(s)	Lab
WY	University of Wyoming	public	EAC-ABET	EE 4560	none

Table 45: Universities in the State of Wyoming

State	University name	Type	Accreditation	Course(s)	Lab
DC	Howard University	<i>private</i>	EAC-ABET	EECE 418	none
DC	George Washington University	<i>private</i>	EAC-ABET	ECE 6662	none

Table 46: Universities in the Washington D.C.