

# Power Electronics

## Graduate Capstone Certificate and Master of Science in Electrical Engineering



Advance your career in the growing field of power electronics and electric machines from a top 10 online graduate program as ranked by *U.S. News and World Report*.

### What You Learn

- Learn the latest technology in power electronics, electric machines, actuators, sensors, drives, motion control and drive applications.
- Learn from distinguished and internationally renowned faculty from the Department of Electrical and Computer Engineering and the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC)
- Tailor your experience to fit your specific career goals and interests through technical elective courses

### Where & How You Learn

**Where** Online; start in summer, fall, or spring.

**How** Start by completing a 9-credit certificate program in Power Conversion and Control (PCC). With successful completion of this Certificate and a minimum GPA of 3.3, you may apply to the online MS degree in Power Engineering. The PCC credits are applied to the 30-credit master's degree requirement.

You have an opportunity to meet and learn with faculty and fellow students at one required, on-campus, three-week summer lab.

“ UW Madison’s online power engineering: electrical engineering program allowed me to work full time while gaining the additional academic skills necessary to advance in the field of power engineering. I was promoted to the next level of engineer the spring before my graduation and I don’t think that would have happened without this program.

*Helen Lewis-Rzeszutek, Senior Hardware Engineer, Rockwell Automation.* ”

### Apply Now!

Visit [go.wisc.edu/Power](http://go.wisc.edu/Power)

### At a Glance

**Delivery:** Online

**Credits:** 30 graduate credits

**Time Frame:** 1 year for the PCC Certificate, an additional 2-3 years for the MS degree in Power Engineering, depending on the number of classes taken each term

**Tuition: Resident and non-resident:** \$1,600 per credit

### Typical Curriculum

#### Required Courses, PCC Certificate

- Introduction to Electric Drive Systems
- Power Electronic Circuits
- Automatic Controls

#### Core ECE MS Curriculum: Power Engineering

- Electric Machine and Drive System Lab
- Power Electronics Lab
- Dynamics and Control of AC Drives
- Solid State Power Conversion

#### Typical Electives

- Electric Power Systems
- Computer Control of Machines and Processes
- Electromagnetic Design of AC Machines
- Utility Application of Power Electronics

### Questions?

For more information on admission requirements, how to apply, tuition and financial aid or other questions, contact:

Graduate Programs Coordinator  
608-262-0468  
[gradadmissions@epd.wisc.edu](mailto:gradadmissions@epd.wisc.edu)



# Sample Plan of Study

	Course Number	Course Title	Credits
<b>Power Conversion and Control (PCC) Certificate</b>			
Fall 1	ECE411	Introduction to Electric Drive Systems	3
Spring 1	ECE412	Power Electronic Circuits	3
Summer 1	ME446	Automatic Controls	3
<b>Core ECE MS Curriculum: Power Engineering<sup>2</sup></b>			
Fall 2	ECE712	Solid State Power Conversion	3
Spring 2	ECE711	Dynamics and Control of AC Drives	3
Summer 2	ECE504 <sup>3</sup>	Electric Machine and Drive System Lab	3
	ECE512 <sup>4</sup>	Power Electronics Lab	
<b>Technical Electives<sup>5</sup></b>			
Fall 3	ECE713	Electromagnetic Design of AC Machines	3
Spring 3	ECE427	Electric Power Systems	3
	ME447	Computer Control of Machines and Processes	
	ECE511	Theory and Control of Synchronous Machines	
	ECE/ME739	Advanced Robotics	
Summer 3	ECE714 <sup>6</sup>	Utility Application of Power Electronics	3
Fall 4	ME746	Dynamics of Controlled Systems	3
	ME747 <sup>7</sup>	Advanced Control of Machines and Processes	

<sup>1</sup> Listed courses and schedule are subject to change

<sup>2</sup> Must apply for admission to MS program with a minimum GPA of 3.3 in the PCC Certificate

<sup>3</sup> Offered even-year summers

<sup>4</sup> Offered odd-year summers

<sup>5</sup> Total of Five 700-level Courses Required

<sup>6</sup> Prerequisite for ECE714 is ECE427

<sup>7</sup> Prerequisite for ME747 is ME447

**Flexible Curriculum**  
**In-Depth Technical Knowledge**  
**Start Summer, Fall, or Spring**  
 Learn more at [go.wisc.edu/Power](http://go.wisc.edu/Power)

## Required Courses, PCC Certificate

### Introduction to Electric Drive Systems

Learn the basic theory underlying the analysis and design of adjustable-speed drive systems employing power electronic converters and AC or DC machines. Learn the basic concepts of torque and speed control in both DC and AC machines, including variable-frequency operation of induction and synchronous machines, field-oriented control, and more.

### Power Electronic Circuits

In this introduction to the basic power electronic devices, you will study and analyze fundamental power conditioning converters. Course material will cover piecewise linear, uncontrolled circuits; power electronic devices; and AC/DC, DC/DC, AC/AC, and resonant converters.

### Automatic Controls

This course provides a comprehensive understanding of single input, single output (SISO) continuous closed-loop control system analysis and design. Discrete (computer) control also is introduced including analysis in the z domain.

## Core ECE MS Curriculum: Power Engineering

### Electric Machine and Drive System Lab

This laboratory course consists of a series of experiments exploring the steady-state and dynamic performance of electric machines in combination with power electronic converters. Learn techniques for parameter measurement and performance evaluation of induction, PM synchronous, and switched reluctance machine drives, including exercises to compare predicted and measured performance characteristics. This is a three-week summer course offered in even years. Campus attendance is required.

### Power Electronics Lab

This laboratory introduces the measurement and simulation of important operating characteristics related to power electronic circuits and power semiconductor devices. Emphasis will be given to devices, circuits, gating methods, and power quality. This is a three-week summer course offered in odd years. Campus attendance is required.

### Dynamics and Control of AC Drives

This course covers the development and application of techniques needed to analyze and control the dynamic performance of AC machine drive systems using power electronic converters. Content includes d-q rotating reference frame modeling of AC machines and power converters needed for closed-form analysis and simulation of both AC induction and synchronous machines, leading to exploration of high-performance control techniques including current regulation, field orientation control, and direct torque control.

### Solid State Power Conversion

Learn systematic analytical techniques to critically study the design and control of power converters of various topologies and functions. You will also receive a brief introduction to EMI analysis and mitigation techniques.

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