ECE 5410 Syllabus
Power Electronics and Control

Credit Hours:
4 Credit Hours (LCT 4).

WSU Catalog Description:
Prereq: ECE 4330. Control of electrical energy using solid state devices, diodes, thyristors, and triacs; mathematical analysis of circuits containing these devices; power converters and control; solid-state drives for motor control.

Instructor: Dr. Caisheng Wang,
Course Meeting Time: Tuesday and Thursday, 10:30 AM - 12:10 PM
Course Meeting Location: 1151 MAIN
Office Hours: Tuesday and Thursday, 2:30 PM – 3:30 PM
Office Location: 3146 Engineering Building
Phone: (313) 577-7084
Email: cwang@wayne.edu

Prerequisite(s): ECE 4330: Linear Network and System Analysis.

Co-requisite(s): None.

Textbook(s) Required:

Recommended References:

Computer Programs:
MATLAB/Simulink and PSpice

Goals:
Understand basic power electronic devices and their application in power conversion/conditioning technologies and. Know how to use simulation software such as MATLAB and PSpice for power converter design and simulation.

Course Objectives:
Upon completion of this course the student will be able to:
1. Understand basic principles of Power Switching Devices.
2. Understand the losses generated at active and passive components.
3. Understand various power conversion topologies/circuits.
4. Model typical power converters.
5. Understand basic principles of power converter control.
6. Understand the applications of power electronic converters in alternative energy systems
7. Simulate and design a simple DC/DC converter.
8. Simulate and design a simple DC/AC inverter.
9. Design simple controllers for typical power converters

**Topics/Tentative Schedule:**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Week</th>
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<tbody>
<tr>
<td>Review of Basic Electrical and Magnetic Circuits</td>
<td>1 Week</td>
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<tr>
<td>Overview of Power Electronic Systems and Semiconductor Switches</td>
<td>1 Week</td>
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<tr>
<td>AC/DC and Thyristor Circuits</td>
<td>1 Week</td>
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<tr>
<td>Introduction to Power Electronic Simulation Software Programs</td>
<td>½ Week</td>
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<tr>
<td>DC/DC Converters</td>
<td>2 Weeks</td>
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<tr>
<td>Lab Demo of Various DC/DC Converters</td>
<td>½ Week</td>
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<tr>
<td>DC/AC Converters</td>
<td>2 Weeks</td>
</tr>
<tr>
<td>Lab Demo of DC/AC Converters</td>
<td>½ Week</td>
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<tr>
<td>Fundamentals of Feedback Control</td>
<td>1 Week</td>
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<tr>
<td>Modeling of Power Electronic Converters</td>
<td>½ Week</td>
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<tr>
<td>Feedback Control of Power Electronic Converters</td>
<td>1 Week</td>
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<tr>
<td>Applications of Power Electronic Converters</td>
<td>1 Week</td>
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<td>Practical Design Issues</td>
<td>1 Week</td>
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<tr>
<td>Final Project Presentation</td>
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<tr>
<td>Final Exam</td>
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Contributions to the ECE Program Outcomes:

(a) *An ability to apply math, science and engineering knowledge.* The homework, project, quizzes and exams require direct applications of mathematical, scientific, and engineering knowledge to successfully complete the course.

(c) *An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.* The design in the project must be checked against real world operating limits.

(e) *Identify, formulate and solve engineering problems.* Students must be able to identify and model the system; analyze and solve control problems.

(g) *An ability to communicate effectively.* Students are required to write a comprehensive report on the project.

(k) *An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.* Students taking the course will learn how to use software tools such as MATLAB and other commercial software (PSpice) for solving practical power electronic problems.

**Grading Policy:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Project</td>
<td>25%</td>
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<tr>
<td>Testes/Quizzes</td>
<td>30%</td>
</tr>
<tr>
<td>Final</td>
<td>30%</td>
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**Grading Scale:**

- **A** 93-100
- **A-** 90-92
- **B+** 87-89
- **B** 83-86
- **B-** 80-82
- **C+** 77-79
- **C** 73-76
- **C-** 70-72
- **D+** 67-69
- **D** 63-66
- **D-** 60-62
- **F** Below 60
Schedules:

- Homework due: one week after completing the corresponding chapters/topics
- Project due: April 26
- Final Exam: April 26

Attendance:

Students are expected to attend all lectures. The most common reasons for failing this course are (1) not attending all lectures and (2) not having sufficient time spent on the course.

WITHDRAWAL POLICY:

Last day to drop with a tuition refund: End of 2nd Week of Semester
Last day to drop without a notation of W on the transcript: End of 4th Week

Depending on the situation of withdrawal, one of the following grades will be assigned:
WP: Withdrawal with Passing
WF: Withdrawal with Failing
WN: Withdrawal Never Attended

All drop/add activity during the first four weeks should be done by the student through Pipeline. Withdrawal after the fourth week requires the instructor’s permission and must be submitted on a Drop/Add form to the Registrar’s Office. Withdrawal after the ‘final drop’ date will only be permitted under exceptional circumstances and requires the permission of the Chair of the ECE department. A failing grade is not an acceptable reason for withdrawal after the ‘final drop’ date.

POLICY ON CHEATING:

Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course and may be subject to additional penalties. See http://www.otl.wayne.edu/wsu_integrity.php for more details.

Code of Ethics for Engineers:
WSU library has a tutorial that talks about transmitting ideas, plagiarism, copyright, and citing sources. At the end, there is a quiz. You are encouraged to visit this site then take the quiz at the end.
http://www.lib.wayne.edu/services/instruction_tutorials/searchpath/mod6/contents.html

The following list gives additional sites:
http://onlineethics.org/codes/
http://www.iit.edu/departments/csep/codes/coe/abet-a.html

AVAILABILITY TO STUDENTS WITH DISABILITIES
If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, the instructor will meet with you privately to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.

Last Updated: December, 2016

Prepared by: Dr. Caisheng Wang