

Power Electronics – Physics 541
Fall 2020
SUNY College at Cortland
Physics Department

Catalog Description

Application of electronics to energy control and conversion with a focus on renewable energy systems. Topics include: amplifier circuits, power semiconductor devices, D.C. to A.C. power conversion, computer based modeling of circuit behavior, New York State and National Electrical Codes, and a final research project involving the design and simulation of novel electronic devices. Prerequisite: PHY 540 (3 cr. hr.)

Required Texts

- *Power Electronics* (3rd Ed.) by N. Mohan, T. Undeland, and W. Robbins ISBN:9780471226932.
- *NFPA70 National Electrical Code* (2017 Ed.) National Fire Protection Association ISBN:9781455912773.

Instructor Information

Instructor: Douglas Armstead
Office: 127 Bowers (607) 753-2919
Office Hours: TWR 1-2pm and by appointment.
Email: douglas.armstead@cortland.edu
Course Website: <http://facultyweb.cortland.edu/douglas.armstead/F20/PowerElectronics.html>
Lecture meets: MW 4:25pm-5:40pm in Bowers 1113.

Expectations

What you should expect from me:

- Explanations of physical concepts that include concrete examples and, where reasonable, demonstrations.
- In-class examples that help you to develop the level of reasoning that is necessary to do the problems you will encounter in the homework and on exams.

- Careful and respectful consideration of your questions.
- An open door policy—if my office door is open you should feel free to come in and talk about physics. This is in addition to my regularly scheduled office hours listed above.

What I expect of you:

- Your presence in class, both physical and mental, for the entire class period.
- To prepare for class. This includes doing the reading at a level that you arrive with questions in hand about the material.
- When you have a question, ask it. Your fellow classmates will thank you—if you are unclear on something, chances are the person next to you is, too.
- Submit work for grading that is your own. If you copy from another student or source and submit it for a grade, then you risk receiving an F in the course.

Grades

The final score for the class is found in the following way:

$$score = \frac{H + P + E_1 + E_2}{4} \quad (1)$$

H =homework average, P =Final project, $E_i=i^{th}$ exam. Each element is out of 100.

The homework is a vehicle for your mastering the concepts, techniques, and thought processes relevant to Power Electronics and for communicating this in a way that leads from beginning to end using a clear, methodical plan. There are a number of aids at your disposal: the book, the instructor, in and out of class; and your classmates. But in the end nothing beats quiet concentration and gradually sorting things out for yourself.

Some homework will involve spice simulation and you should think of those simulations as an important part of the solution but that a full solution includes an explanation of your results.

Homework will typically be assigned on Thursday and due on the following Thursday, when solutions will be provided. Allowing late homework is not really in your best interest and will generally not be accepted.

For the project in the course you will either design and make circuits using pulse width modulation for PV systems or design grid-connected PV system with supporting utility interconnection documentation. This work will be carried out under the supervision of the course instructor and, when applicable, with the cooperation of regional business or non-profit partners.

Make-up exams will only be administered for “Excused Absences” (see University Catalog for details). Supporting documentation to excuse your absence will be required.

The score is mapped into a grade roughly as:

Class Schedule

All dates are tentative.

Project Presentation at 4-6pm on Monday December 14, 2020

Final %	Grade
90-100	As
80-89	Bs
70-79	Cs etc.

Improvement and class participation may be used raise a border line grade.

Week	Chapter(s)	Topic
8/31	Mohan 1	Overview
9/7	Mohan 2, 3	Semi-conductors, Review of Basics Class does meet on Labor Day 9/7.
9/14	Mohan 4.1, 4.6 & 5	Circuit Simulation and Rectifiers ($AC \rightarrow DC$ converters)
9/21	Mohan 7	$DC \rightarrow DC$ converters Exam 1 on Part 1 on 9/23.
9/28	Mohan 7	$DC \rightarrow DC$ converters cont.
10/5	Mohan 8	Inverters ($DC \rightarrow AC$ converters)
10/12	Mohan 17.4	Maximum Power Point and Utility interconnection
10/19	supplimental	CAD and interconnection
10/26	supplimental	CAD and interconnection Exam 2 on Part 2, 10/28.
11/2	NEC articles 90 and 690	Overview and Solar PV Project plan due, 11/4.
11/9	NEC	Ampacity and Conduits
11/16	NEC	Grounding and Fault protection
In person instruction ends.		
11/23		Thanksgiving break week
Remote instruction only.		
11/30		Project
12/7		Project Project Paper due 12/9

Academic Integrity Statement

All students are expected to uphold academic integrity standards. Plagiarism is defined as taking the ideas of others and using them as one's own without due credit. Students who cheat in examinations, course assignments, or plagiarize in this course may be disciplined in accordance with university rules and regulations.

Disability Statement

As part of SUNY Cortland's commitment to a diverse, equitable, and inclusive environment, we strive to provide students with equal access to all courses. If you believe you will require accommodations in this course, please place a request with the Disability Resources Office at disability.resources@cortland.edu or call 607-753-2967. Please note that accommodations are

generally not provided retroactively so timely contact with the Disability Resources Office is important. All students should consider meeting with their course instructor who may be helpful in other ways.

Diversity Statement

SUNY Cortland is dedicated to the premise that every individual is important in a unique way and contributes to the overall quality of the institution. We define diversity broadly to include all aspects of human difference. The College is committed to inclusion, equity, and access and thus committed to creating and sustaining a climate that is equitable, respectful and free from prejudice for students, faculty and staff. We value diversity in the learning environment and know that it enhances our ability to inspire students to learn, lead and serve in a changing world. We are committed to promoting a diverse and inclusive campus through the recruitment and retention of faculty, staff and students. As a community, we hold important the democracy of ideas, tempered by a commitment to free speech and the standards of inquiry and debate. To this end, we are dedicated to developing and sustaining a learning environment where it is safe to explore our differences and celebrate the richness inherent in our pluralistic society.

Inclusive Learning Environment Statement

SUNY Cortland is committed to a diverse, equitable and inclusive environment. The course instructor honors this commitment and respects and values differences. All students enrolled in this course are expected to be considerate of others, promote a collaborative and supportive educational environment, and demonstrate respect for individuals with regard to ability or disability, age, ethnicity, gender, gender identity/expression, race, religion, sex, sexual orientation, socio-economic status or other aspects of identity. In an environment that fosters inclusion, students have the opportunity to bring their various identities into conversation as they find helpful, but are not expected to represent or speak for an entire group of people who share aspects of an identity. If you have any questions or concerns about this statement, contact the Institutional Equity and Inclusion Office at 607-753-2263.

Title IX Statement

Title IX, when combined with New York Human Rights Law and the New York Education Law 129-B, prohibits discrimination, harassment and violence based on sex, gender, gender identity/expression, and/or sexual orientation in the education setting. The federal Clery Act and NY Education Law 129-B provide certain rights and responsibilities after an incident of sexual or interpersonal violence. When a violation occurs, victims and survivors are eligible for campus and community resources. Where the College has jurisdiction, it may investigate and take action in accordance with College policy. If you or someone you know wishes to report discrimination based in sex, gender, gender identity/expression, and/or sexual orientation, or wishes to report sexual harassment, sexual violence, stalking or relationship violence, please contact the Title IX Coordinator at 607-753-4550, or visit cortland.edu/titleix to learn about all reporting options and resources. (Updated by SUNY Legal Feb. 1, 2018).