



ECE 4930/ ECE 6930: INTRODUCTION OF POWER ELECTRONICS TECHNOLOGY

Spring 2021

MEETING TIME: MW 2:30-3:45 p.m.

INSTRUCTOR: Zheyu Zhang

309 ZUCKER FAMILY GRADUATE EDUCATION CENTER

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OFFICE HOURS AND PROCEDURES: MW 1:00-2:00 p.m. through Zoom Personal Meeting Room

<https://zoom.us/j/2947747574?pwd=UTBkeklUL09tbVhEczRHdmp1UG9lZz09>

Meeting ID: 294 774 7574

Passcode: dh1G9W

COURSE MODALITY: ONLINE SYNCHRONOUS

COURSE DESCRIPTION: Power electronics is the application of solid-state electronics to the control and conversion of electric power. It is the key enabler for various applications, such as electrified transportation, drives, and smart grid. The course is an introduction to switched-mode power converters. It provides a basic knowledge of circuitry for the control and conversion of electrical power with high efficiency. These converters can change and regulate the voltage, current, or power; dc-dc converters, ac-dc rectifiers, dc-ac inverters, and ac-ac cycloconverters are in common use. The course targets for senior undergraduate and graduate students who are interested in power electronics.

COURSE PREREQUISITES: ECE2020 Electric Circuits I, ECE2620 Electric Circuits II, and ECE3600 Electric Power Engineering

STUDENT LEARNING OUTCOMES: At the completion of the course, students should be able to 1) understand the fundamentals of power electronics converter analysis in steady state, 2) understand the converter dynamics and control, 3) understand the basics of magnetics design for power electronics converters, and 4) confidently use PLECS & MATLAB to design a DC/DC converter, it will be demonstrated by several assignments and a project with all the detailed designs included.

REQUIRED MATERIALS:

Textbook: Erickson and Maksimovic, Fundamentals of Power Electronics, second edition, Kluwer Academic Publishers, ISBN 0T7923T7270T0

Simulation software: PLECS and MATLAB

Student is required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone.

TOPICAL OUTLINE:

1. Converters in Equilibrium

- Principles of steady-state converter analysis
- Steady-state equivalent circuit modeling, losses, and efficiency

- Switch realization
 - The discontinuous conduction mode
 - Converter circuits
2. Converter Dynamics and Control
 - AC modeling
 - Converter transfer functions
 - Controller design
 3. Magnetics for Power Converters
 - Basic magnetics theory
 - Filter inductor design
 - Transformer design

CLASS CANCELLATION POLICY: Class is cancelled if the instructor is more than 15 minutes late to class.

GRADING POLICY: [Grading must include both a GRADE SCALE and the relative WEIGHTING. An example of a grade scale is 90-100 A, 80-89.9 B, 70-79.9 C, 60-69.9 D, 50-59.9 F. An example of a WEIGHTING is Homework 10%, 2 Tests 20% each, Project 20%, Final Exam 30%.

A – 90% - 100%; B – 80 to < 90%; C – 70 to < 80%; D – 60 to < 70 & F – < 60% (Undergraduate Students)

A – 90% - 100%; B – 80-89%; C – 70-79%; & F – < 70% (Graduate Students)

	Undergraduate	Graduate
Homework (~ five)	40 %	20 %
Participation and discussion	5 %	5 %
Project (team-based)	10 %	20 %
Student presentation (team-based)	5 %	15 %
Final exam	15 %	15 %
Final report (survey paper on power electronics technology and applications)	25 %	25 %
Total	100 %	100 %

ATTENDANCE POLICY:

1. Online attendance is mandatory.
2. Should you miss a class (including online), it is YOUR RESPONSIBILITY to contact with your instructor within one week to deliver the written excuse by email. Missing class WILL AFFECT your final grade. See grading policy below.
3. A student will be marked absent if not in class/online within 5 minutes of starting time. This can be changed into a tardy. The student is responsible for contacting the instructor after class.
4. The student is responsible for asking the professor to change an absence into a tardy if the student arrived more than 5 minutes late immediately after the class in which the tardy occurs. (No changes will be made on a later day.) The third tardy will result in a loss of 2 participation points, the fourth 2 more points, etc.
5. Exception — for part-time graduate students, absence is exempt if it is due to the full-time job (e.g. scheduled meeting, biz travel, etc.). Please send an email to your instructor before the class, in the meantime, make sure you will spend equivalent time to review the lecture slides and learn by yourselves.

ACCESSIBILITY STATEMENT: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course

design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

TITLE IX STATEMENT: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware. There are two important exceptions to this requirement about which you should be aware:

Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.

SAFE CAMPUS: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

[You are strongly encouraged to include this statement exactly as worded.]

ACADEMIC INTEGRITY: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic

Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

COPYRIGHT STATEMENT: Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

MODIFICATION STATEMENT: The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations. The date of this version of the syllabus is January 5, 2021

Testing procedures – Details will be provided in Canvas announcements.

Procedures for turning in homework – online is highly recommended, even for hybrid courses.

Final exam MUST be online.