

The University of Texas at El Paso
Department of Electrical & Computer Engineering

SYLLABUS
ECE 4315 (CRN 25055), ECE 5390 (CRN 25056) and
ECE 6390 (CRN 27888)
Introduction to Power Electronics

COURSE INFORMATION

Term: Spring 2026

Delivery Method: In-person

Meeting Day and Time: Tuesdays and Thursdays, 3:00 PM – 4:20 PM

Location: Chemistry Computer Science Building, room 1.0202

Total number of credits: 3

INSTRUCTOR INFORMATION

Instructor: Dejana Cucak, PhD

Assistant Professor

Department of Electrical and Computer Engineering

Office A-334

Phone number: (915) 747-6632

E-mail: dcucak@utep.edu

OFFICE HOURS

- Face-to-Face: Tuesdays and Thursdays from 4:30 PM- 5:30 PM
- Virtual: via MS Teams (by email appointment only)

COURSE DESCRIPTION

ECE 4315, 5390 and 6390 Introduction to Power Electronics course focuses on operating principles and modeling of power converters. Non-isolated (buck, boost and buck-boost) and isolated DC/DC converters (flyback, full-bridge and push-pull) will be presented, explained and modeled in steady-state. The analysis will be based on volt-second balance, charge-second balance and small ripple approximation. The average DC steady-state model will be derived and presented for one non-isolated and for one isolated topology.

Line-commutated single-phase and three-phase AC/DC rectifiers will be analyzed and explained. Power Factor and Total Harmonic Distortion will be introduced and calculated for single-phase and three-phase topologies. Introduction to PWM switching rectifiers will be made, focusing on basic operating principles and advantages comparing to non-regulated line-commutated rectifiers.

Finally, basic operating principles of DC/AC inverters will be presented. Single-phase and three-phase switch-mode inverters will be analyzed in detail. Different types of modulation (unipolar versus bipolar) will be introduced, analyzed and compared in terms of the performance.

PREREQUISITE

C or better grade in ECE3341 (Electronics I).

COREQUISITE

ECE4115 Power Electronics Laboratory.

REQUIRED MATERIALS

Erickson, R. W., Maksimovic, D. (2020). *Fundamentals of Power Electronics*. Springer (An e-book available for free via UTEP's Springer subscription at <https://link-springer-com.utep.idm.oclc.org/book/10.1007/978-3-030-43881-4>) ISBN: 9783030438814

RECOMMENDED MATERIALS

Mohan, N., Undeland, T. M. and Robbins W. P. (1995). *Power Electronics: Converters, Applications and Design*. 2nd Edition, John Wiley & Sons Inc., New York. ISBN: 9780471584087

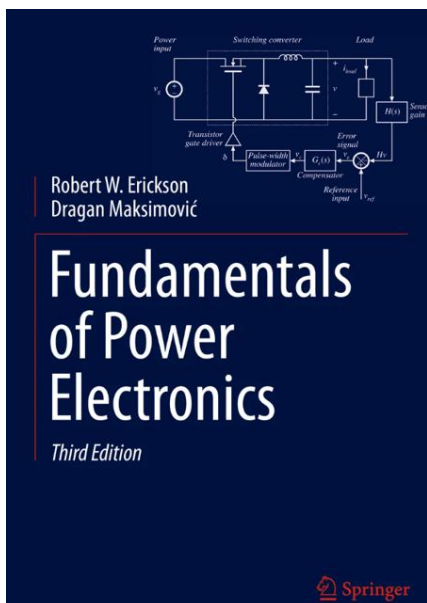


Figure 1: Required material.

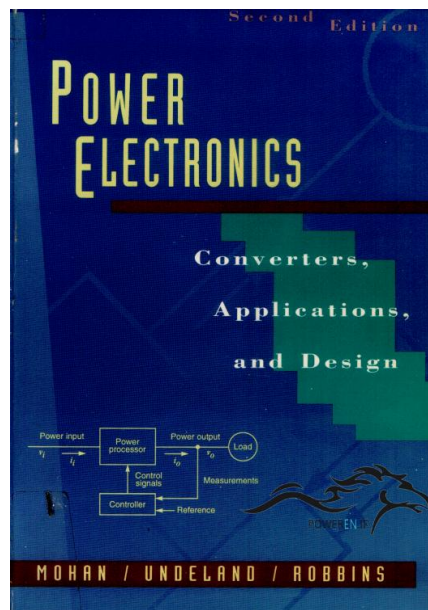


Figure 2: Recommended material.

COURSE OBJECTIVES

By the end of the course, students will be able to:

- Understand the operating principles of buck, boost, buck-boost, flyback, full-bridge and push-pull topology
- Apply volt-second balance, charge-second balance and small ripple approximation in the analysis of DC/DC converters
- Calculate steady-state duty-cycle value for each of the aforementioned topologies
- Obtain relevant voltage and current waveforms in steady-state
- Obtain steady-state average model for buck, boost and buck-boost converter
- Perform analysis of single-phase and three-phase uncontrolled rectifiers in steady-state
- Calculate power factor and total harmonic distortion for single-phase and three-phase rectifiers
- Analyze single-phase and three-phase DC/AC inverters using different modulation techniques

COURSE FORMAT

The lectures are scheduled twice a week from 3:00 pm – 4:20 pm every Tuesday and Thursday during the term. The schedule for the lab work will be additionally posted. The course format includes lectures, assignments, class discussions, lab work and exams.

ASSIGNMENTS AND GRADING

Grades will be given based on the following distribution:

Participation	10%
Homework assignments	30%
Exams	60%
Total	100%

The grades will be given in the following way:

90-100%	➡	A
80-89%	➡	B
70-79%	➡	C
60-69%	➡	D
59% or below	➡	F

COURSE TOPICS

- Introduction to switching power converters.
- Non-isolated DC/DC converters – operating principles and steady state modeling.
- Switching semiconductor devices – basic principles.
- Transformers – basic principles and modelling.
- Isolated DC/DC converters.
- AC/DC rectifier topologies.
- DC/AC inverter topologies.

Disclaimer: Syllabus may be slightly adjusted if needed. The adjustments will be made if students demonstrate the need for additional topics that were not covered in prerequisites.

ASSIGNMENTS AND CLASS PARTICIPATION

Power electronics is a cross-section of several fundamental areas of electrical engineering: analog electronics, semiconductor devices, magnetics design, control and stability analysis. In order to successfully design a power converter that will fulfill a given set of specifications, it is mandatory to have required skills in each of the aforementioned areas. Therefore, critical thinking, problem description and troubleshooting are key aspects for every power electronics design engineer. For this reason, class attendance is highly important. A sign-in sheet will be distributed in each class, to keep track of attendance and students' participation in discussions. Class attendance will be included in the Final Grading.

Assignments (or Homework) will be posted online or informed via email/blackboard. The assignments will be related to theoretical concepts presented in the class. Students are expected to complete the assigned work before the deadline. Instructions for submission of assignments will be provided. Late homework submission is not encouraged. Every assignment submitted after the deadline will automatically lose 50% of the maximum graded value for that assignment. Assignments will not be accepted a week after the deadline. Failure in assignment submission will result in zero points.

EXAMS

There will be closed book exams. Detailed instructions will be provided prior to each exam. Students should remain fully silent throughout the exam period. If there are any students involved in talking, they will receive zero points on that particular exam.

Make-up exams are not possible in general, and effort should be made to attend each exam. However, in the event of emergency due to medical reasons (doctor's report required), military duties or compassionate reasons, a student should inform the Instructor as soon as possible. In such cases, a make-up exam will be possible.

There will be two exams: the first exam will be on March 12^h and the second exam after the course is completed (after May 7th).

TECHNOLOGY REQUIREMENTS

Some course content is delivered via the Internet through the Blackboard learning management system. Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

You will need to have access to a computer/laptop. You will need to download or update the following software: Microsoft Office, Adobe Acrobat Reader, Windows Media Player/QuickTime. Check that your computer hardware and software are up-to-date and able to access all parts of the course.

If you do not have word-processing software, you can download Word and other Microsoft Office programs (including Excel, PowerPoint, Outlook and more) for free via UTEP's Microsoft Office Portal. Click the following link for more information about [Microsoft Office 365](#) and follow the instructions.

IMPORTANT: If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP [Technology Support](#) as they are trained specifically in assisting with technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you.

COURSE COMMUNICATION

Here are the ways we can keep the communication channels open:

- Office Hours: I will have office hours for your questions and comments about the course. My office hours are in-person, however, you can request a virtual meeting and I will send you an MS Teams link. Please see the days and times at the top of this syllabus.
- Email: UTEP e-mail is the best way to contact me. I will make every attempt to respond to your e-mail within 24 hours of receipt. When e-mailing me, be sure to email from your UTEP student e-mail account and please put the course number in the subject line. In the body of your e-mail, clearly state your question. At the end of your e-mail, be sure to put your first and last name, and your university identification number.
- Announcements: Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

ATTENDANCE AND PARTICIPATION

Our class meetings are in-person at Chemistry Computer Science Building, Room 1.0202, every Tuesday and Thursday from 3:00 am to 4:20 pm, beginning January 20 through May 7.

Attendance on the course is determined by participation in the learning activities of the course. Your participation in the course is important not only for your learning and success but also to create a community of learners. Participation is determined by the completion of the following activities:

- Reading/Viewing the course material after each class in order to be up to date with the covered chapters.
- Participating in problem solving discussions and troubleshooting with your peers.

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

ILLNESS PRECAUTIONS

Please stay home if you have symptoms of a communicable illness. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodation.

EXCUSED ABSENCES AND/OR COURSE DROP POLICY

I will not drop you from the course. However, if you feel that you are unable to complete the course successfully, please let me know and then contact the [Registration and Records Office](#) to initiate the drop process. If you do not, you are at risk of receiving an “F” for the course.

DEADLINES, LATE WORK, AND ABSENCE POLICY

Assignments

- Writing assignments will be due on Sundays at midnight (11:59 PM) via Blackboard. Every assignment submitted after the deadline will automatically lose 50% of the maximum graded value. Assignments won't be accepted a week after the deadline. Failure in assignment submission will result in zero points.

MAKE-UP WORK

Make-up work will be given *only* in the case of a *documented* emergency. Note that make-up work may be in a different format than the original work, may require more intensive preparation, and may be graded with penalty points. If you miss an assignment and the reason is not considered excusable, you will receive a zero. It is

therefore important to reach out to me in advance if possible and explain with proper documentation why you missed a given course requirement. Once a deadline has been established for make-up work, no further extensions or exceptions will be granted.

ALTERNATIVE MEANS OF SUBMITTING WORK IN CASE OF TECHNICAL ISSUES

I strongly suggest that you submit your work with plenty of time to spare in the event that you have a technical issue with the course website, network, and/or your computer. I also suggest you save all your work in a separate Word document as a backup. This way, you will have evidence that you completed the work and will not lose credit. If you are experiencing difficulties submitting your work through Blackboard, please contact the UTEP Help Desk. You can email me your backup document as a last resort.

INCOMPLETE GRADE POLICY

Incomplete grades may be requested only in exceptional circumstances after you have completed at least half of the course requirements. Talk to me immediately if you believe an incomplete is warranted. If granted, we will establish a contract of work to be completed with deadlines.

ACCOMMODATIONS POLICY

The University is committed to providing reasonable accommodations to students with documented disabilities. Students who become pregnant may also request reasonable accommodations, in accordance with state and federal laws and regulations and University policy. Accommodations that constitute undue hardship are not reasonable. To make a request, please register with the UTEP Center for Accommodations and Support Services (CASS). Contact CASS at 915-747-5148, email them at cass@utep.edu, or apply for accommodations online via the CASS portal.

SCHOLASTIC INTEGRITY

Academic dishonesty is prohibited and is considered a violation of the UTEP Handbook of Operating Procedures. It includes, but is not limited to, cheating, plagiarism, and collusion. Cheating may involve copying from or providing information to another student, possessing unauthorized materials during a test, or falsifying research data on laboratory reports. Plagiarism occurs when someone intentionally or knowingly represents the words or ideas of another as ones' own. Collusion involves collaborating with another person to commit any academically dishonest act. Any act of academic dishonesty attempted by a UTEP student is unacceptable and will not be tolerated. All suspected violations of academic integrity at The University of Texas at El Paso must be reported to the [Office of Community Standards](#) for possible disciplinary action. To learn more, please visit [HOOP: Student Conduct and Discipline](#).

GUIDANCE ON ARTIFICIAL INTELLIGENCE

AI prohibited

Use of AI technologies or automated tools, particularly generative AI such as ChatGPT or DALL-E, is **not allowed** for assignments in this class. Each student is expected to use critical and creative thinking skills to complete tasks and not rely on computer-generated ideas. Any direct use of AI-generated materials submitted as your own work will be treated as plagiarism and reported to the [Office of Community Standards](#).

CLASSROOM ENVIRONMENT POLICIES

- Please arrive at the classroom before the lecture starts.
- There is NO FOOD POLICY in the classroom. Only water, coffee or soft drinks are allowed.
- NO CELL PHONE POLICY – during the class, please keep your cell phone completely switched-off or in silent mode. In case of emergency during lecture hours, you are allowed to leave the classroom to make a phone call, text messages etc., and you can rejoin the class afterwards.
- LAPTOP and E-Tablet POLICY: You are allowed to use your laptop / IPAD / e-tablet for browsing lecture materials or for writing notes while in the classroom. Participation in social network interaction, personal chatting and anything not related to the course is not allowed.