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

SYLLABUS
ECE 4190, ECE 5190 and ECE 6190
Power Electronics Laboratory

COURSE INFORMATION

Term: Spring 2026
Delivery Method: In-person
Meeting Day and Time: Wednesday from 11:30am – 2:20pm (Group 1) and 3:00pm-5:50pm (Group 2)
Location: E301E Intro to Electrical & Computer Engineering Lab
Total number of credits: 1

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

The course covers laboratory work in power electronics. The lab session will use DC/DC converters designed by Texas Instruments. Two buck converter topologies used for the measurements are TI-PMLK BUCK TPS54160 and TI PMLK BUCK LM3475 are shown in Fig. 1. The other two converters are boost TI PMLK TPS 55340 and TI PMLK LM5122 shown in Fig. 2.

The total number of testbeds will vary between eight and ten, depending on the number of students. Each testbed will have the DC power supply connected to the input of the converter, different power resistors soldered on small pcb boards connected to the load side, oscilloscope with voltage and current probes in order to measure switching voltage and current waveforms and multimeters in order to measure input and output voltage. One testbed is shown in Fig. 3 while converter under test is shown in Fig. 4.

Figure 1: BUCK converters for the lab demonstrations.

Figure 2. BOOST converters for the lab demonstrations.

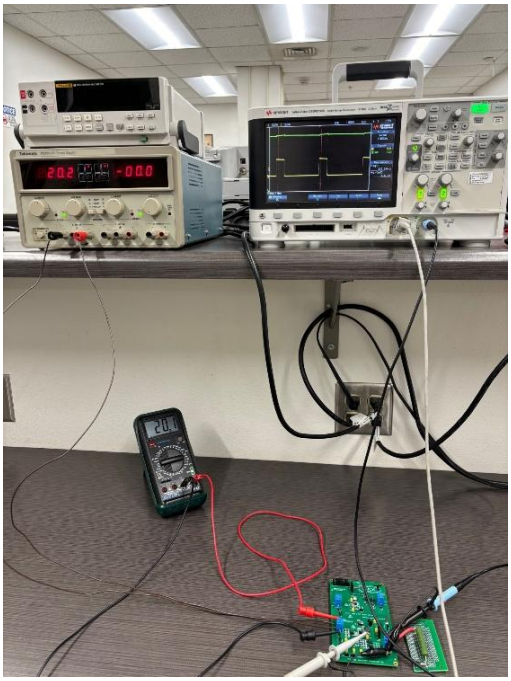

Figure 3: Testbed for DC/DC converter measurements.

Figure 4: DC/DC converter under test.

The first group of lab sessions with introduce LM3475 buck converter that can operate with input voltage between 5-10V, providing fixed output voltage of 2.5V and output current up to 1A. The lab sessions will include measurements of input voltage, output voltage, switching node voltage, inductor current and input current of the converter. The change in duty cycle value will be observed and measured for different values of the input voltage. The effect of the output capacitor value on the output voltage ripple will be observed and measured. The efficiency of the converter will be measured for two different values of the load resistor.

The second group of lab sessions will use TPS54160 buck converter that can operate with input voltage between 6-36V, providing fixed output voltage of 3.3V and maximum output current of 1.5A. The lab sessions will include measurements of duty cycle for different input voltages, measurements of inductor current ripple for different inductor values, output voltage ripple for different capacitor values and efficiency of the converter for different values of the load current, input voltage and switching frequency. Efficiency dependence on the load current and switching frequency will be plotted and analyzed.

The third group of lab sessions will use LM5122 boost converter, which operates with input voltage between 9-20V, providing fixed output voltage of 24V and maximum output current of 2A. The ripple of the input current will be observed on the oscilloscope for two different inductor values. Input, output and switching node voltage will be measured. Duty cycle values for different input voltages will be observed and measured. Efficiency of the converter will be measured and plotted for different load resistor values.

The final group of lab sessions will use TPS55340 boost converter, which operates with input voltage between 5-12V, providing fixed output voltage of 24V and maximum output current of 1.9A. The ripple of the output voltage will be observed and measured for two different values of the output capacitor. Efficiency of the converter will be measured at two different switching frequencies for different values of the load resistor.

PREREQUISITE

C or better grade in ECE3341 (Electronics I).

COREQUISITE

ECE 4315 (Introduction to Power Electronics).

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

[PMLKBUCKEVM Evaluation board | TI.com]

[PMLKBOOSTEVM Evaluation board | TI.com]

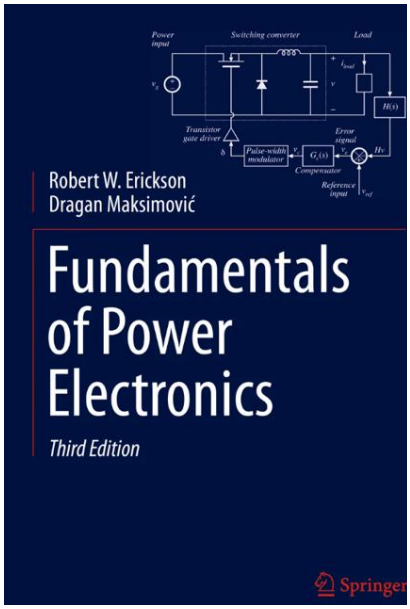

Figure 5: Required material.

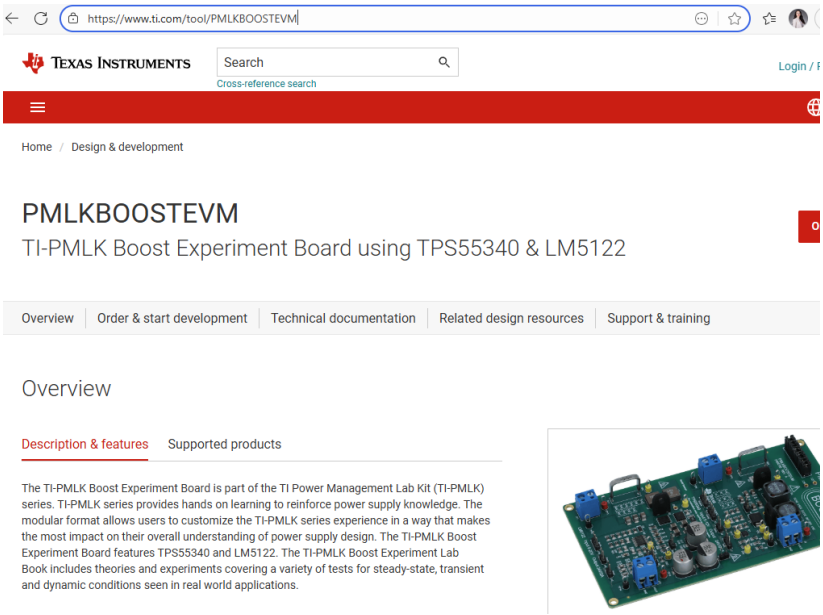

Figure 6: Converter specifications (required material).

COURSE OBJECTIVES

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

- Connect, adjust and use oscilloscope for different measurements
- Connect, adjust and use a DC power supply
- Connect, adjust and use multimeters
- Use oscilloscope to measure voltage and current waveforms in the converter under test
- Use multimeters to measure input and output voltage
- Understand how output capacitor value affects ripple of the output voltage
- Understand how inductor value affects inductor current ripple
- Measure efficiency of the converter under test
- Understand how efficiency of the converter depends on output current and switching frequency

COURSE FORMAT

The lab location and the schedule for the lab sessions are TBD.

ASSIGNMENTS AND GRADING

Grades will be given based on the following:

Lab work	100%
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

- Analysis and measurements on TI PMLK LM3475 and TPS54160 buck converters
- Analysis and measurements on TI PMLK LM5122 and TPS55340 boost converters
- Behavior of each converter with different inductor/capacitor values
- Effect of input voltage, output current and switching frequency on the efficiency of the converter

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.

GRADING

Each lab session will have predefined list of measurements that need to be performed and documented. In addition to the measurements, each session will contain a set of quiz questions related to the topology under test. The grade will be given based on the ability to accurately perform measurements as well as the ability to answer the quiz questions.

SAFETY INSTRUCTIONS

Each lab session will start with the introduction of the topology under test, explaining important precautions while performing the measurements. The DC power supply for

each testbed will be turned on ONLY by the Instructor or Teaching Assistant. The voltage and current probes should be connected to the converter BEFORE the power supply is turned on and SHOULD NOT be moved while the converter is running. While the converter under test is running, students MUST NOT touch the converter or the load resistor. Any modification in the operating conditions such as increase in the input voltage, needs to be supervised by the Instructor or Teaching Assistant. Apart from the hardware, ONLY paper, pen and calculator are allowed on a testbed table.

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.

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.

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.

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.

LABORATORY ENVIRONMENT POLICIES

- Please arrive at the laboratory before the lab session starts.
- There is NO FOOD and NO DRINKS POLICY in the lab.
- NO CELL PHONE POLICY – during the lab session, please keep your cell phone completely switched-off or in silent mode. In case of emergency, you are allowed to leave the lab to make a phone call, text messages etc., and you can rejoin 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 lab. Participation in social network interaction, personal chatting and anything not related to the course is not allowed.