



浙江大學

ELEC509
Power Electronics

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Instructor Contact Details

Lecturer-in-charge: Dr. Zihan Zhang

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Office location: Huajiachi Campus, Zhejiang University, Hangzhou, China

Consultation Time: Book appointment by sending email to: wlwyxy_29@zju.edu.cn

Teaching Times, Modes and Locations

Course Duration: 23 Dec 2024 to 10 Jan 2025

Modes: Online/Face-to-face

Location: Anywhere via online, or Huajiachi Campus, Zhejiang University via face-to-face

Academic Level

Undergraduate

Credit Points:

The course is worth 6 units of credit point.

Credit Hours

The number of credit hours of this course equals to the credits of a standard semester-long course.

Contact Hours

The course contains a total of 53 contact hours, which consists of orientation, lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, self-study, and final exam. Students will receive an official transcript which is issued by Zhejiang University when completing this course.

Enrolment Requirements

Eligibility requires enrollment in an overseas university as an undergraduate or postgraduate student, proficiency in English, and pre-approval from the student's home institution.

Course Description:

This unit provides a fundamental understanding of power electronics, covering the principles and control of power electronic converters and systems. Students will learn to analyze, design, simulate, and control power electronic converters, including DC/DC, DC/AC, AC/DC, and AC/AC topologies. The course covers modern power semiconductor devices, such as power diodes, MOSFETs, IGBTs, and thyristors, along with their switching and protection techniques. Through hands-on laboratory experience with industrial systems like electrical motor drives and robotic arms, students will bridge theory with real-world applications. The course also emphasizes the analysis of waveform quality at the input and output of converters, preparing students for roles in the design, application, and maintenance of power electronic circuits.

Prerequisite:

Prior knowledge in fundamental accounting is required for taking this course.

Learning Resources

- Xiao, Weidong. "Power electronics step-by-step: design, modeling, simulation, and control." (2021).
- N. Mohan, T. M. Undeland & W. P. Robins, "Power Electronics; Converters, Applications and Design", John Wiley, Second Edition, 1995, New York.

Learning Objectives

By the end of this course, you should be able to:

- Understand and Analyze Power Semiconductor Devices: Explain the operation, strengths, switching, and protection techniques of modern power semiconductor devices, including power diodes, MOSFETs, IGBTs, thyristors, and GTOs.
- Analyze and Evaluate Power Conversion Systems: Understand and analyze DC-DC, AC/DC, and DC/AC power converters in steady-state, including the modeling, simulation, and performance evaluation of these systems.
- Design and Troubleshoot Power Converters: Develop skills to test, troubleshoot, and evaluate the performance of various power converters, ensuring their effective operation in real-world applications.
- Analyze Waveform Quality: Analyze the quality of waveforms at the input and output ends of power converters, addressing concerns important to both users of modern power converter circuits and utility authorities.

Course Delivery:

- Online Lecture mode includes lectures, seminars, quiz, discussion, research, case study, small tests, assignments, online field trip(s), in-class activities, revision, and final exam.
- Face-to-face Lecture mode includes lectures, seminars, quiz, discussion, research, case study, small tests, assignments, on-site field trip(s), in-class and after-class activities, revision, and final exam.

The following course will be taught in English. There will also be guest speakers and optional field trips available for students who would like to enhance their learning experience. All courses and other sessions will be run during weekdays.

Topics and Course Schedule:

WK	Topic	Activities
1	Orientation	
1	Introduction and start power semiconductor devices	Lecture; Tutorial
1	Power semiconductors and electromagnetics	Lecture; Tutorial
1	Diode rectifier circuits Single-phase thyristor rectifier circuits	Lecture; Tutorial
1	Analysis, Design, and Simulation of Buck Converters	Lecture; Tutorial
1	Boost converters, switching loss and gate drivers	Lecture; Tutorial
2	Buck converter analysis techniques	Lecture; Tutorial
2	Seminar	
2	Full-wave and three-phase	Lecture; Tutorial
2	DC/AC converters and DC motors	Lecture; Tutorial
2	Quiz	Closed book
2	Introduction to Single-phase DC-AC circuits	Lecture; Tutorial
3	DC to single-phase AC conversion Single-phase AC to DC conversion	Lecture; Tutorial
3	Introduction to Three-phase DC-AC circuits	Lecture; Tutorial
3	DC to three-phase AC conversion and Switched capacitor	Lecture; Tutorial

	converter	
3	Flyback converter analysis Forward converters	Lecture; Tutorial
3	Analysis, design, and simulation of Isolated DC/DC converters	Lecture; Tutorial
3	Revision	Tutorial
3	Final exam	Closed book

Assessments:

Class participation	15%
Quiz	15%
Assignments	20%
Final exam	50%

Grade Descriptors:

HD	High Distinction	85-100
D	Distinction	75-84
Cr	Credit	65-74
P	Pass	50-64
F	Fail	0-49

High Distinction 85-100

- Treatment of material evidences an advanced synthesis of ideas Demonstration of initiative, complex understanding, and analysis.
- Work is well-written and stylistically sophisticated, including appropriate referencing, clarity, and some creativity where appropriate.
- All criteria addressed to a high level.

Distinction 75-84

- Treatment of material evidences an advanced understanding of ideas Demonstration of initiative, complex understanding and analysis Work is well-written and stylistically strong.
- All criteria addressed strongly.

Credit 65-74

- Treatment of material displays a good understanding of ideas.
- Work is well-written and stylistically sound, with a minimum of syntactical errors.

- All criteria addressed clearly.

Pass 50-64

- Treatment of material indicates a satisfactory understanding of ideas Work is adequately written, with some syntactical errors.
- Most criteria addressed adequately.

Fail 0-49

- Treatment of ideas indicates an inadequate understanding of ideas Written style inappropriate to task, major problems with expression.
- Most criteria not clearly or adequately addressed.

Academic Integrity

Students are expected to uphold the university's academic honesty principles which are an integral part of the university's core values and principles. If a student fails to observe the acceptable standards of academic honesty, they could attract penalties and even disqualification from the course in more serious circumstances. Students are responsible for knowing and observing accepted principles of research, writing and any other task which they are required to complete.

Academic dishonesty or cheating includes acts of plagiarism, misrepresentation, fabrication, failure to reference materials used properly and forgery. These may include, but are not limited to: claiming the work of others as your own, deliberately applying false and inaccurate information, copying the work of others in part or whole, allowing others in the course to copy your work in part or whole, failing to appropriately acknowledge the work of other scholars/authors through acceptable referencing standards, purchasing papers or writing papers for other students and submitting the same paper twice for the same subject.

This Academic Integrity policy applies to all students of the Zhejiang University in all programs of study, including non-graduating students. It is to reinforce the University's commitment to maintain integrity and honesty in all academic activities of the University community.

Policy

The foundation of good academic work is honesty. Maintaining academic integrity upholds the standards of the University. The responsibility for maintaining integrity in all the activities of the academic community lies with the students as well as the faculty and the University. Everyone in this community must work together to ensure that the values of truth, trust and justice are upheld.

Academic dishonesty affects the University's reputation and devalues the degrees offered. The University will impose serious penalties on students who are found to have violated this policy. The following penalties may be imposed:

- ✓ Expulsion

- ✓ Suspension
- ✓ Zero mark /fail grade
- ✓ Marking down
- ✓ Re-doing/re-submitting of assignments or reports, and
- ✓ Verbal or written warning.