



浙江大學

**ELEC507**

**Electro-mechanical System Design**

# **ELEC507**

## **Electro-mechanical System Design**

### Instructor Contact Details

Lecturer-in-charge: Dr. Bohao Yang

Email: wlwyxy\_29@zju.edu.cn

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 comprehensive introduction to electro-mechanical systems, focusing on the integration of electrical and mechanical power systems, electronics, and mechatronics. Students will explore basic electrical theory, including Ohm's law, Kirchoff's laws, and the characteristics of passive components, along with an introduction to transistors, operational amplifiers, and digital logic. The course covers sensors for measuring physical phenomena, AC and polyphase systems, electromagnetism, various motors, motor speed control, and power supplies. Practical components include assembling circuits, using measurement tools, and interfacing sensors and actuators with the Arduino system for simplified mechatronics. Additionally, the course delves into drive systems, detection technology, and control technology, incorporating mechanical transmission, hydraulic systems, and electric drive technology. Emphasis is placed on system modeling, simulation methods, and the latest research developments in electro-mechanical systems.

### Prerequisite:

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

### Learning Resources

- Lyshevski, Sergey Edward. Electromechanical systems and devices. CRC Press, 2008.
- Krause, Paul C., Oleg Wasynczuk, and Timothy O'Connell. Introduction to the Analysis of Electromechanical Systems. John Wiley & Sons, 2021.

### Learning Objectives

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

- Understand and Apply Electrical Engineering Theorems: Grasp the theorems essential for circuit design in electro-mechanical systems and utilize electronics to address mechanical and mechatronic engineering challenges.
- Analyze and Diagnose Electronic Circuits: Develop skills to measure, analyze, and diagnose faults in electronic circuits, ensuring accurate functionality and problem resolution.
- Design and Build Engineering Solutions: Design, simulate, and construct circuits to effectively solve engineering problems, integrating theoretical knowledge with practical applications.
- Effective Communication and Teamwork: Enhance oral and written communication

skills to convey circuit-related concepts clearly, and collaborate effectively in small groups to solve technical problems.

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 to Electromechanical Systems	Lecture; Tutorial
1	Prototyping electronic circuits using breadboard Lab1: Familiarization with circuit design, simulation and prototyping	Lecture; Tutorial
1	Analysis of Electromechanical Systems and Devices	Lecture; Tutorial
1	Introduction to op amps, applications in processing sensor signals	Lecture; Tutorial
1	Introduction to Power Electronics	Lecture; Tutorial
2	Introduction to capacitors and inductors Lab2: Circuits to work with sensors	Lecture; Tutorial
2	Seminar	
2	Decision making using microcontrollers and transistors	Lecture; Tutorial
2	Fundamentals of motors and servos	Lecture; Tutorial

	Powering high-current circuits using PWM	
2	Quiz	Closed book
2	Direct-Current Electric Machines and Motion Devices	Lecture; Tutorial
3	Fundamentals of microcontrollers (basic code for interfacing to circuits) Lab3: Circuits to make things move	Lecture; Tutorial
3	In-depth analysis of several important circuits Discussion about power supplies	Lecture; Tutorial
3	Induction Machines	Lecture; Tutorial
3	Synchronous Machines	Lecture; Tutorial
3	Exploring the principles of modular system design	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.