Electrical Engineering Graduate Programs

I. About the EE College

The College of Electrical Engineering (the EE College) of Zhejiang University, one of the ancient electrical engineering departments in China, has since 1920 graduated over 25,000 students, including 22 academicians of the Chinese Academy of Science and the Chinese Academy of Engineering. With over 100 faculty members, the College has currently about 1500 registered full-time undergraduate students, 600 master students and 350 doctoral students. It strives to explore an innovative way of educating students with leadership, global vision, innovation awareness and full readiness for their chosen field.

There are 3 undergraduate programs in the College, Electrical Engineering and its Automation, Electronic Information Engineering, and Automation. In respect of graduate education, there are 2 disciplines, Electrical Engineering, and Control Science and Engineering. Of them, the Electrical Engineering discipline ranks consistently among the best nationwide, and was selected into the list of the national first-class disciplines in the year of 2017.

The EE College combines interdisciplinary strengths of Zhejiang University to develop vibrant and diverse research programs in tackling issues of national importance and of international technological frontiers. Grounded on its close relationship with industrial partners in Yangtze River Delta, a center of Chinese economic development, the EE College maintains stable and frequent collaborative relationships with State Grid of China, China Southern Power Grid, Shanghai Electric, CRRC and many other state-owned enterprises in areas of research, talent training, and student internship, etc. With its rising international impact, the College attracts as well research collaborations from world-renown industrial partners like Ford Motor, GE, BOSCH, Fuji Electric, Qualcomm and ALSTOM. Over 20 joint laboratories and research centers have so far been established with the industry and research institutions. The EE College has hosted over 10 international conferences in the recent 5 years, including the 13th IEEE Vehicle Power and Propulsion Conference (VPPC 2016), the 17th International Conference on Electrical Machines and Systems (ICEMS 2014), and the 21st IEEE International Symposium on Industrial Electronics (ISIE 2012).

II. Research Highlights

The EE College's research features cover combinations of electrical and electronic systems, components and equipment, software and hardware in the scope of electrical engineering.

Generations of hard work by the EE College faculty have yielded impressive achievements such as the first double water inner-cooled electrical generator of China (in 1950s), the first thyristor-based medium-frequency induction heating power supplies (in 1960s) which enabled the industry of solid-state inductive heating power supplies in the country, and foundation of Industrial Electronics (in 1970s) which was the origin of modern power electronics in China. In 1980s, the EE College faculty contributed to the key technologies of the first HVDC project in China, and in 1990s it reported the first set of fabric CAD system nationwide. Early in the 21st century, its faculty successfully developed electrical drive for environment control and life support system for space crafts and EVA space suits. The College currently aims at advancing key technologies like smart grid, renewable energy, advanced power semiconductor devices, high-speed and high-efficiency motor drives, intelligent robot, intelligent sensing and communication, etc.

In the recent 10 years, the EE College has been granted 384 national-level research projects, with the annual research funding averaging 150 million RMB. The collaborative research efforts contributed to 43 major research awards, including 9 national awards. Meanwhile, over 3900 papers were published (more than 1000 of which were included in the Scientific Citation Index) and 436 patents were granted.

III. About Electrical Engineering Graduate Programs

The EE College offers the following degrees to its international students who have successfully completed Electrical Engineering graduate programs:
Master of Science (MS)
Doctor of Philosophy (PhD)

Both the MS & PhD Programs in Electrical Engineering are particularly designed for international students who are interested in Electrical Engineering, varying from areas of Electrical Machines and Electrical Apparatus, Power Systems and Automation, High Voltage and Insulation Technology, Power Electronics and Electrical Drives, Theory of Electrical Engineering and New Technology, to Electrical Information Technology.

The selection of course modules is tailored to the student's professional objectives for them to pursue diverse interests in the research field of Electrical Engineering. All the selected courses are conducted in English by teachers with years of overseas experiences.

MS Program in Electrical Engineering

It takes 2.5 years on average for MS candidates to complete the program and obtain the Master Degree. Completion of the program requires a minimum of 24 credits of coursework during the first academic year from admission into the program. The courses should be selected and approved in consultation with the candidates' supervisors. The candidates are required to take 2+ years on research work, and approved dissertation writing that demonstrates the student's ability to perform original and independent research.

Course Descriptions

Course Type	Total Credits	Courses	Credits	Period	Course Introduction
Electrical Engineering Core Courses	≥6	Power Semiconductor Devices and Application	1	16	The course introduces the power devices concepts, basic circuit topologies and reflections on device application, device integration perspectives and so on. Power semiconductor device materials, diodes, power transistors, MOSFET and IGBT electrical properties and physical properties are introduced. Introduce the requirements of MOSFET and IGBT device driver, and how to design the MOSFET and IGBT drive and protective circuits. Analyze heat sources and heat transfer characteristics of power devices. According to the influence of temperature on power semiconductor devices, the thermal design technologies are introduced for power semiconductor devices.
		Modern permanent magnet machine theory and control	2	32	Permanent magnet (PM) electric machines have received extensive research interests and applications, due to the development of modern electric machine theories, materials, power electronics and control theories. This course is designed to introduce magnetic materials and fundamental electromagnetic theories, and also to introduce principle and control strategies of PM machines. The course will help students understand the basic theory and gain the R&D skills of PM machines and control systems.

		Power Electronics 2	2	32	This course introduces the first-rate teaching style and cutting technologies, aiming to improve the internationalization level of students. The main content of this course is as follows: review of basic DC/DC converters steady state operation and dynamic modeling techniques; voltage mode and current mode control of DC/DC converters; introduction to Resonant DC/DC Converters; introduction to Modular Multilevel Converters; concepts of Magnetics for Power Electronics.
		Power system operation and control	2	32	Power system operation and control is a fundamental course for EE major. The contents of the course include specialty knowledge, such as basic characteristic of generator operation, mathematical model for power system economical dispatch, modal and algorithm for power system unit commitment.It is an important course for students to master the foundation of the major, deepen their professional ideas and develop their professional horizons.
Electrical Engineering Elective Courses	≥4	Electric and Hybrid Vehicle Propulsion Systems	1	16	This course will introduce the electric and hybrid vehicle architectures, the propulsion system analysis, fuel cell technology and fuel cell vehicles, the energy storage, electric motor drive systems, power electronic converters for electric and hybrid vehicles, energy management and charging, and characteristics of commercially available hybrid vehicles.
		Semiconductor Material and Device Characterization	2	32	An overview of state-of-the-art characterization techniques routinely employed to determine semiconductor material and device parameters. Concepts and theory underlying the techniques are reviewed, and sample experimental results are presented. Emphasis is on techniques employing electrical characterization methods.
		Smart Electric Power Distribution Systems	2	32	This course works systematically through basic distribution principles, renewable energy sources, computational tools and techniques, reliability, maintenance, distribution automation, and telecommunications. Numerous examples, problems, and case studies offer practical insight into the concepts and help build a working

					knowledge of protection schemes, fault analysis and synthesis, reliability analysis, intelligent automation systems, distribution management systems, and distribution system communications.
		System Identification	2	32	The contents include introduction to system identification, system model for time-invariant linear system, time and frequency domain identification process, least square method, Kalman filter and its applications, etc.The underlying system is mainly focused on linear system, while a brief introduction as well as off-class assignments will be given on time-varying nonlinear system. In addition, the final grade will be determined by both mid-term and final exams. In particular, mid-term exam will be on-class test on theoretical derivation or practical applications involving computer programming.
		Modern Electromagnetic Field	2	32	This course is oriented for the creativity accumulation of the students in the related field. It covers the hot topics of the state of the art in engineering electromagnetics, as well as those in computational electromagnetics. It is an important course for students to master the theory and method of modern electromagnetics, and grasp the development direction of current computational electromagnetism.
		Frontiers in Power Semiconductor Devices	2	32	Course contents will include developments in the following a few different aspects: new device structures, devices based on new semiconductor materials and new processing techniques to implement these new devices. New devices structures will cover Super-Junction structure, Lateral Multi-RESURE structure. New materials will cover SiC & GaN. In SiC devices, the course will introduce SiC diodes, BJT, JFET, MOSFET, Thyristor, IGBT etc. GaN devices will include HEMFET, MOSFET & Diode. For each device, operating mechanism, device structure, processing requirements, existing challenges and future trends will be introduced and discussed in detail.
		Intelligent Control and	2	32	Intelligent control and intelligent system is a young and attractive research topic in the information and automation area.

		Intelligent Systems			In this course, the fundamentals of intelligent control and intelligent systems are introduced, as well as their principles and applications. The main contents include expert system and expert control, fuzzy sets, genetic algorithms and evolutionary computation, and various neural network models. Related research topics are also introduced.
		Advanced Technology of Power Electronics Devices	2	32	This course introduces the fundamentals of semiconductors, basic configuration of different power devices, such as MOSFET, IGBT, SiC and so on. And the dynamic switching performance at different operation conditions will be highlighted to understand the concept of steady and dynamic safety operation area (SOA). Furthermore, the detailed characteristic of high power devices at short-circuit operation and other extremely conditions will be performed to give a better understanding of their reliability. The multiple physics field model of power devices will also be introduced for the practical converter design.
		Sub-Micro Devices and Nanoelectronics	3	48	Nano electronics is the promoting and join fields along microelectronics, optics and solid state electronics. The students will be taught forward-thinking and frontier exploration capabilities. Task: Make students aware of new nanoelectronic devices structures， principles，creativeness，and innovative ideas.
Required Courses by the University	5	Survey of China	3	48	此课程由国际教育学院开设，由中文授课 This course is conducted in Chinese by the International College of Zhejiang University
		Chinese Language	2	32	此课程由国际教育学院开设，由中文授课 This course is conducted in Chinese by the International College of Zhejiang University
Required Courses by the University	2	Introduction to Chinese Calligraphy	2	32	As China has been playing an increasingly important role in the global community, great attention has been paid to Chinese culture, history and art as well. Shufa, or Chinese calligraphy, the core of Chinese culture, or the highest art from China in the

(liberal arts)					eyes of Western scholars of Chinese studies, has drawn much attention too. The course aims to provide both an overall introduction to this typical field of China studies and an opportunity of personal experience of the art itself.

Note: Electrical Engineering core and elective courses taught in Chinese are also available to international students who have good command of Chinese.

PhD Program in Electrical Engineering

It takes 3.5+ years for PhD candidates to complete the program and obtain the PhD Degree. Completion of the program requires a minimum of 12 credits of coursework during the first academic year from admission into the program. The courses should be selected and approved in consultation with the candidates' supervisors. The candidates are required to take 3+ years on research work, and approved dissertation writing that demonstrates the student's ability to perform original, independent research and constitutes a distinct contribution to knowledge in the principal field of study.

Course Descriptions

Course Type	Total Credits	Courses	Credits	Period	Course Introduction
Electrical Engineering Core Courses	≥2	Frontiers in Power Semiconductor Devices	2	32	Course contents will include developments in the following a few different aspects: new device structures, devices based on new semiconductor materials and new processing techniques to implement these new devices. New devices structures will cover Super-Junction structure, Lateral Multi-RESURE structure. New materials will cover SiC & GaN. In SiC devices, the course will introduce SiC diodes, BJT, JFET, MOSFET, Thyristor, IGBT etc. GaN devices will include HEMFET, MOSFET & Diode. For each device, operating mechanism, device structure, processing requirements, existing challenges and future trends will be introduced and discussed in detail.
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		Intelligent Systems			control and intelligent systems are introduced, as well as their principles and applications. The main contents include expert system and expert control, fuzzy sets, genetic algorithms and evolutionary computation, and various neural network models. Related research topics are also introduced.
Electrical Engineering Elective Courses	≥2	Power Semiconductor Devices and Application	1	16	The course introduces the power devices concepts, basic circuit topologies and reflections on device application, device integration perspectives and so on. Power semiconductor device materials, diodes, power transistors, MOSFET and IGBT electrical properties and physical properties are introduced. Introduce the requirements of MOSFET and IGBT device driver, and how to design the MOSFET and IGBT drive and protective circuits. Analyze heat sources and heat transfer characteristics of power devices. According to the influence of temperature on power semiconductor devices, the thermal design technologies are introduced for power semiconductor devices.
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		Chinese	2	32	此课程由国际教育学院开设，由中文授课

		Language			This course is conducted in Chinese by the International College of Zhejiang University
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IV. Contact

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