大学专门用途英语系列教材

English for Electrical Engineering

电气工程英语

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总主编／肖　飞
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外语教学与研究出版社
FOREIGN LANGUAGE TEACHING AND RESEARCH PRESS

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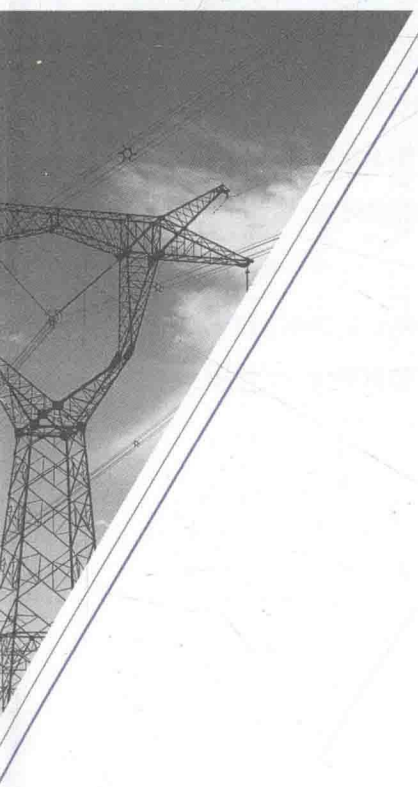

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前言

根据《大学英语教学指南》的精神，大学英语的课程体系主要由通用英语、专门用途英语和跨文化交际三大类课程组成。

大学专门用途英语系列教材充分体现《大学英语教学指南》的精神，在大学英语教学改革实践的基础上，以培养与专业英语相关的英语能力为目标，将特定的学科内容与英语语言学习相结合，兼顾语言输入与输出训练，帮助学生实现在英语语境下对学科知识的有效输出和应用。

大学专门用途英语系列教材依据以内容为依托的教学理念编写，具有时代感、知识性和实用性。教材所选内容反映学科主线，体现相关学科的基本知识和前沿信息，兼具专业性和可读性。基于课文内容设计的阅读理解、专业词汇和学术英语词汇练习，帮助学生在理解课文的同时掌握文章中重要词汇，同时注重活学活用和适度扩展。此外，教材还提供设计灵活、注重实效的思辨训练和学术技能训练，帮助学生在实践中提高思辨能力、习得学术规范、培养学术研究能力，从而能够有效、得体地使用英语进行学业学习与学术交流。

大学专门用途英语系列教材能满足学生专业发展的需要，同时保证他们在大学期间的英语语言水平稳步提高。丰富的教学内容和多样的练习形式也为实现分类教学和因材施教提供可能，教师可根据实际需要选择教学内容，制定个性化的教学方案。

大学专门用途英语系列教材的编者们恳请使用者对本书中出现的问题提出宝贵意见和建议，以便再版时改进。

大学专门用途英语系列教材编委会

2017.6

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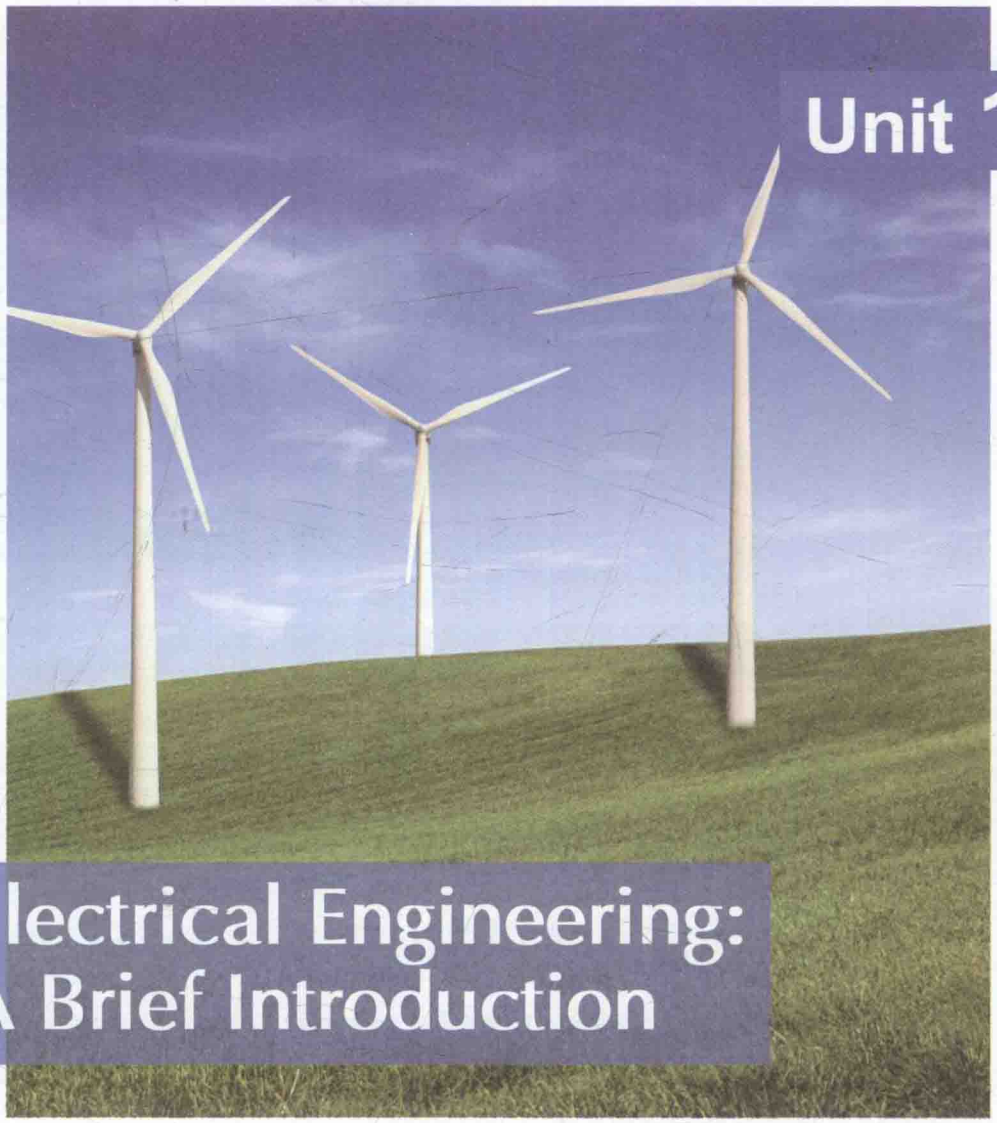


Unit 1

Electrical Engineering: A Brief Introduction

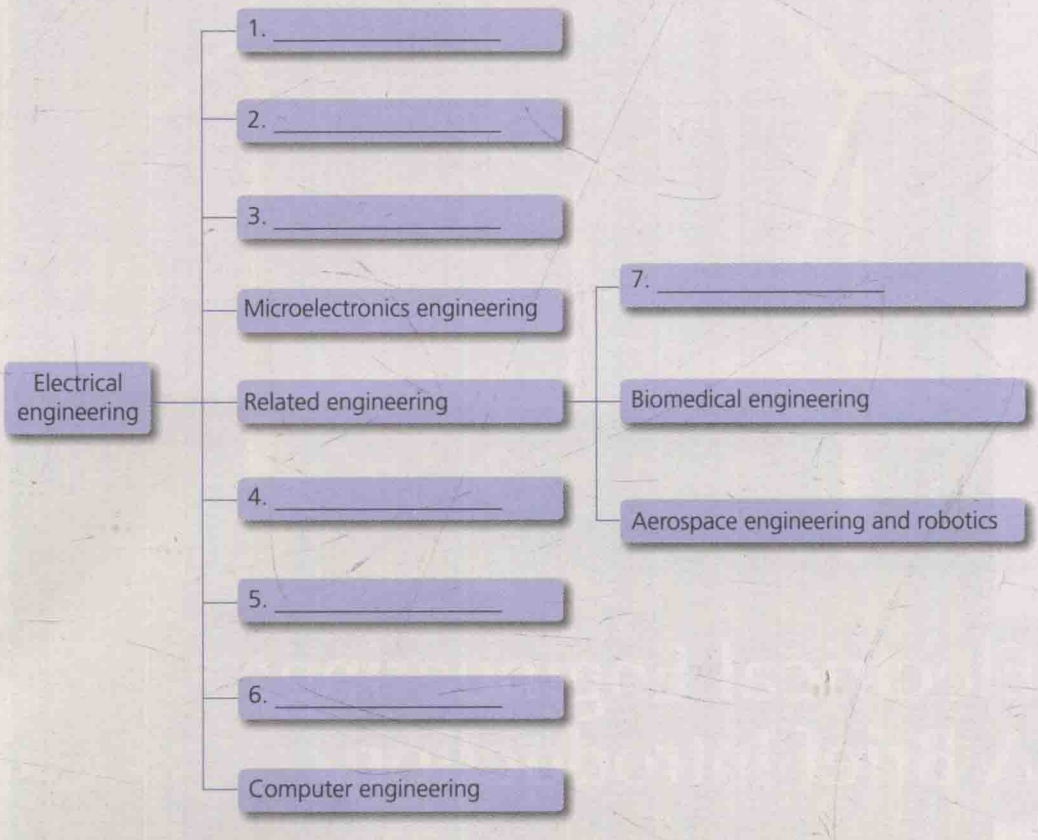
In this unit, you will learn:

- **Subject-related knowledge:** The definition of electrical engineering
  A brief history of electrical engineering
- **Academic skill:** Searching for information
- **Reading strategy:** Dealing with unknown words (Part I)

Section A

Pre-reading

1 Electrical engineering has many sub-disciplines, the most common of which are listed below. Work in groups and fill in the blanks.



2 Discuss the following questions with your partner.

1. What is electricity? What would your life be without electricity?
2. The applications of electrical engineering are very common in our daily life. List at least five of them.

What Is Electrical Engineering?

Text A

1 Electrical engineering is one of the newer branches of engineering, and dates back to the late 19th century. It is the branch of engineering that deals with the technology of electricity. Electrical engineers work on a wide range of components, devices and systems, from tiny microchips to huge power station generators.

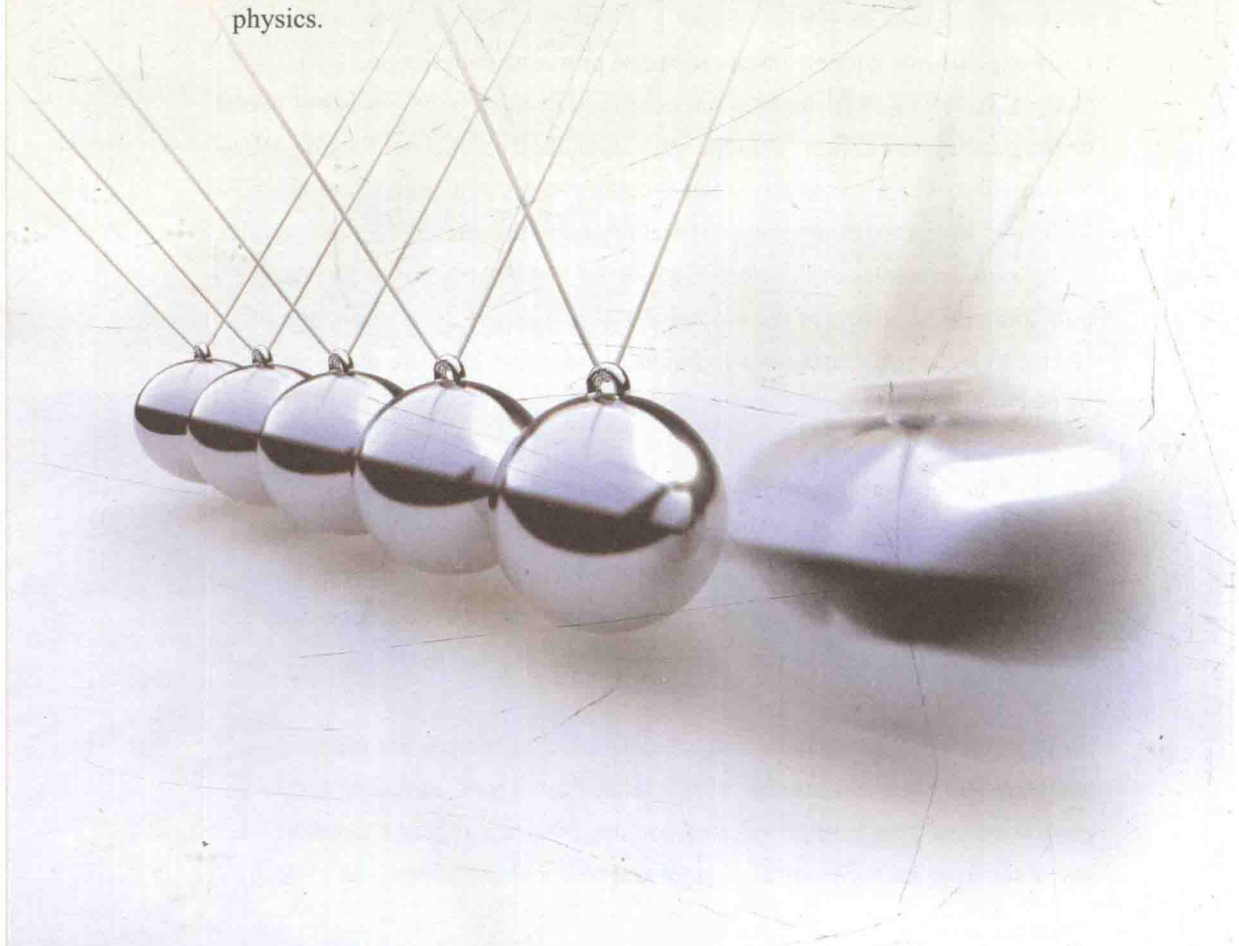
2 Early experiments with electricity included primitive batteries and static charges. However, the actual design, construction and manufacturing of useful devices and systems began with the implementation of Michael Faraday's Law of Induction, which essentially states that the voltage in a circuit is proportional to the rate of change in the magnetic field through the circuit. This law applies to the basic principles of the electric generator, the electric motor and the transformer. The advent of the modern age is marked by the introduction of electricity to homes, businesses and industry, all of which were made possible by electrical engineers.

3 Some of the most prominent pioneers in electrical engineering include Thomas Edison (electric light bulb), George Westinghouse (alternating current, AC), Nikola Tesla (induction motor), Guglielmo Marconi (radio) and Philo T. Farnsworth (television). These innovators turned ideas and concepts about electricity into practical devices and systems that ushered in the modern age.

4 Since its early beginnings, the field of electrical engineering has grown and branched out into a number of specialized categories, including power generation and transmission systems, motors, batteries, digital computers and control systems. Electrical engineering also includes electronics, which

has itself branched into an even greater number of subcategories, such as radio frequency (RF) systems, telecommunications, remote sensing, signal processing, digital circuits, microelectronics, instrumentation, audio, video and optoelectronics.

5 The field of electronics was born with the invention of the thermionic valve diode vacuum tube in 1904 by John Ambrose Fleming. The vacuum tube basically acts as a current amplifier by outputting a multiple of its input current. It was the foundation of all electronics, including radios, television and radar, until the mid-20th century. It was largely supplanted by the transistor, which was developed in 1947 at AT&T's Bell Laboratories by William Shockley, John Bardeen and Walter Brattain, for which they received the 1956 Nobel Prize in physics.



What does an electrical engineer do?

6 "Electrical engineers design, develop, test and supervise the manufacturing of electrical equipment, such as electric motors, radar and navigation systems, communications systems and power generation equipment," states the U.S. Bureau of Labor Statistics (BLS). "Electronics engineers design and develop electronic equipment, such as broadcast and communications systems – from portable music players to global positioning systems (GPS)."

7 If it's a practical, real-world device that produces, conducts or uses electricity, in all likelihood, it was designed by an electrical engineer. Additionally, engineers may conduct or write the specifications for destructive or nondestructive testing of the performance, reliability and long-term durability of devices and components.

8 Today's electrical engineers design electrical devices and systems using basic components such as conductors, coils, magnets, batteries, switches, resistors, capacitors, inductors, diodes and transistors. Nearly all electrical and electronic devices, from the generators at an electric power plant to the microprocessors in your phone, use these few basic components.

9 Critical skills needed in electrical engineering include an in-depth understanding of electrical and electronic theory, mathematics and materials. This knowledge allows engineers to design circuits to perform specific functions and meet requirements for safety, reliability and energy efficiency, and to predict how they will behave, before a hardware design is implemented. Sometimes, though, circuits are constructed on "breadboards", or prototype circuit boards made on computer numeric controlled (CNC) machines for testing before they are put into production.

10 Electrical engineers are increasingly relying on computer-aided design (CAD) systems to create schematics and lay out circuits. They also use computers to simulate how electrical devices and systems will function. Computer

simulations can be used to model a national power grid or a microprocessor; therefore, proficiency with computers is essential for electrical engineers. In addition to speeding up the process of drafting schematics, printed circuit board (PCB) layouts and blueprints for electrical and electronic devices, CAD systems allow for quick and easy modifications of designs and rapid prototyping using CNC machines. A comprehensive list of necessary skills and abilities for electrical and electronics engineers can be found at MyMajors.com.

Electrical engineering jobs and salaries

11 Electrical and electronics engineers work primarily in research and development industries, engineering services firms, manufacturing and the federal government, according to the BLS. They generally work indoors, in offices, but they may have to visit sites to observe a problem or a piece of complex equipment, the BLS says.

12 Manufacturing industries that employ electrical engineers include automotive, marine, railroad, aerospace, defense, consumer electronics, commercial construction, lighting, computers and components, telecommunications and traffic control. Government institutions that employ electrical engineers include transportation departments, national laboratories and the military.

13 Most electrical engineering jobs require at least a bachelor's degree in engineering. Many employers, particularly those that offer engineering consulting services, also require state certification as a professional engineer. Additionally, many employers require certification from the Institute of Electrical and Electronics Engineers (IEEE) or the Institution of Engineering and Technology (IET). A master's degree is often required for promotion to management, and ongoing education and training are needed to keep up with advances in technology, testing equipment, computer hardware and software, and government regulations.

14 As of July 2014, the salary range for a newly graduated electrical engineer with a bachelor's degree is $55,570 to $73,908, according to Salary.com. The range for a mid-level engineer with a master's degree and five to 10 years of experience is $74,007 to $108,640, and the range for a senior engineer with a master's or doctorate and more than 15 years of experience is $97,434 to $138,296. Many experienced engineers with advanced degrees are promoted to management positions or start their own businesses where they can earn even more.

The future of electrical engineering

15 Employment of electrical and electronics engineers is projected to grow by 4% between now and 2022, because of these professionals' "versatility in developing and applying emerging technologies" as the BLS says.

16 The applications for these emerging technologies include studying red electrical flashes, called sprites, which hover above some thunderstorms. Victor Pasko, an electrical engineer at Penn State, and his colleagues have developed a model for how the strange lightning evolves and disappears.

17 Another electrical engineer, Andrea Alù, of the University of Texas at Austin, is studying sound waves and has developed a one-way sound machine. "I can listen to you, but you cannot detect me back; you cannot hear my presence." Alù told LiveScience in a 2014 article.

18 And Michel Maharbiz, an electrical engineer at the University of California, Berkeley, is exploring ways to communicate with the brain wirelessly.

19 The BLS states, "The rapid pace of technological innovation and development will likely drive demand for electrical and electronics engineers in research and development, an area in which engineering expertise will be needed to develop distribution systems related to new technologies."

New words and expressions

component /kəm'pəʊnənt/ *n.*
one of several parts that together make up a whole machine 零件

generator /'dʒenəreɪtə(r)/ *n.*
an engine that converts mechanical energy into electrical energy by electromagnetic induction 发电机

charge /tʃɑːdʒ/ *n.*
the amount of electricity that is put into a battery or carried by a substance 电荷；电量

implementation /ˌɪmplɪmen'teɪʃən/ *n.*
the act of accomplishing some aim or executing some order 履行；执行；实施

voltage /'vəʊltɪdʒ/ *n.*
electrical force measured in volts 电压；伏特数

circuit /'sɜːkɪt/ *n.*
the complete path of wires and equipment along which an electric circuit flows 电路

transformer /træns'fɔːmə(r)/ *n.*
a piece of electrical equipment which changes a voltage to a higher or lower voltage 变压器

advent /'ædvənt/ *n.*
the coming of an important event, person, invention, etc. 出现；到来

prominent /'prɒmɪnənt/ *adj.*
conspicuous in position and importance 显著的；突出的；著名的

AC abbr. (alternating current) 直流电

usher /'ʌʃə(r)/ *vt.*
to cause sth. new to start, or to be at the start of sth. new 宣告；开创

transmission /trænz'mɪʃən/ *n.* 传输

instrumentation /ˌɪnstrʊmen'teɪʃən/ *n.*
the set of instruments used to help in controlling a machine 使用仪器；仪器仪表

optoelectronics /'ɒptəʊɪˌlek'trɒnɪks/ *n.*
光电子学

thermionic /ˌθɜːmɪ'ɒnɪk/ *adj.*
热电子的；热离子的

valve /vælv/ *n.*
a closed glass tube used to control the flow of electricity in old radios, television, etc. 电子管；真空管

diode /'daɪəʊd/ *n.*
an electric device in which the electric current passes in one direction only （电子）二极管

vacuum /'vækjuəm/ *n.*
a space that is completely empty of all gas, especially one from which all the air has been taken away 真空

current /'kʌrənt/ *n.*
a flow of electricity through a conductor 电流

supplant /sə'plɑːnt/ *vt.*
to take the place of, or move into the position of 代替；取代；把……排挤掉

transistor /træn'sɪstə(r)/ *n.*
a semiconductor device capable of controlling the flow of electricity 晶体管

capacitor /kə'pæsɪtə(r)/ *n.*
an electrical device characterized by its capacity to store an electric charge 电容器

inductor /ɪn'dʌktə(r)/ *n.*
an electrical device (typically a conducting coil) that introduces inductance into a circuit 感应器

prototype /'prəʊtəʊtaɪp/ *n.*
a standard or typical example 原型；蓝本

numeric /nju:'merɪk/ *adj.*
measured or expressed in numbers 数字的；数值的

schematic /skɪ'mætɪk/ *n.* 图表；电路图

simulate /'sɪmjʊleɪt/ *vt.*
to create a representation or model, or reproduce someone's behavior or looks 模拟；模仿

amplifier /'æmplɪfaɪə(r)/ *n.*
electronic equipment that increases the strength of signals passing through it 放大器

grid /grɪd/ *n.*
a system of high tension cables by which electrical power is distributed throughout a region 输电网

prototyping /ˌprəʊtəʊ'taɪpɪŋ/ *n.*
样机（原型机）制造；样机研究；原型机设计

versatility /ˌvɜ:sə'tɪlətɪ/ *n.*
having a wide variety of skills 多用途；多才多艺

emerging /ɪ'mɜ:dʒɪŋ/ *adj.*
coming into existence 新兴的

hover /'hɒvə(r)/ *vi.*
to hang in the air, or to move to and fro 盘旋；徘徊

expertise /ˌekspɜ:'ti:z/ *n.*
special skill or knowledge that is acquired by training, study or practice 专门知识或技能

distribution /ˌdɪstrɪ'bju:ʃən/ *n.*
the act of distributing or spreading or apportioning 分配；分布

branch out (into) 涉足；拓展

lay out 展示；设计；安排

Reading comprehension

Fill in the blanks based on the information from Text A with the help of the initial letters given and figure out the paragraphs.

1. Electrical engineering is about the technology of e_____ which dates back to the late 19th century. (Para. ___)
2. Law of Induction, written by Michael Faraday, states that the v_____ in a circuit is proportional to the rate of change in the magnetic field through the circuit. (Para. ___)
3. Electrical engineering has itself branched into an even greater number of subcategories, such as r_____ frequency (RF) systems, telecommunications, remote sensing, signal processing and digital circuits. (Para. ___)
4. It was the invention of the v_____ tube that made electronics widespread and practical in the first half of the 20th century. (Para. ___)
5. The t_____, an IEEE milestone, revolutionized the field of electronics and paved the way for smaller and cheaper radios, calculators and computers. (Para. ___)

Language focus

1 Match the items in Column A with appropriate items in Column B to make fixed phrases in the field of electrical engineering and translate them into Chinese in Column C. Then fill in the blanks of the following sentences with these fixed phrases.

Column A	Column B	Column C
___ 1. electric	A. system	_____
___ 2. static	B. processing	_____
___ 3. current	C. generator	_____
___ 4. transmission	D. charge	_____
___ 5. signal	E. field	_____
___ 6. magnetic	F. amplifier	_____

1. The electricity that is collected on insulators is called _____ because the electricity is at rest.
2. The technology of detecting weak _____ represents the highest level of today's magnetic measurement.
3. A(n) _____ is usually driven by a steam turbine (涡轮机), and this is how most electricity is produced today.
4. A method and apparatus (装置) for _____ which enables data compression and recovery with high transmission efficiency is disclosed.
5. A control circuit which is composed of a capacitor and a _____ is connected in a coil circuit in series.
6. The faults of HVDC power _____ make the electrical characteristics of AC system more complex.

2 Figure out the exact meanings of words in bold in the following groups of sentences, and pay attention to their exact meanings in specialized subject areas.

1. circuit

1) During the car racing, the two cars finished up in a run-off area, clear of

the **circuit**, and that was a mercy. _____

2) There is an internal **circuit** breaker to protect the instrument from overload. _____

3) It is a common problem, the one I'm asked about most when I'm on the lecture **circuit**. _____

2. generator

1) Wicked environment and exceeding use has high requirements to corrosion protection of the wind power **generator** set. _____

2) The results and analysis in this paper provide useful basis for the design and running of once-through steam **generator**. _____

3) Among the top 10 electric power companies in China, State Grid Corporation of China is the largest electricity **generator**. _____

3. versatility

1) Its **versatility**, flexibility, and wide range of implementations and environments make it difficult to describe procedures to cover all cases. _____

2) **Versatility** is another of your strong points, but don't overdo it by having too many irons in the fire. _____

4. branch

1) After the storm last week there were **branches** and twigs all over the ground along the streets of the old town. _____

2) Electrical engineering is a **branch** of engineering science that studies the uses of electricity and the equipment for power generation and distribution and the control of machines and communication. _____

3) Coincident with the talks, Industrial & Commercial Bank was permitted to open a **branch** in another country. _____

3 Fill the blanks with the words and phrases below. Change the form if necessary. Each word or phrase can be used only once.

optoelectronics advent branch out simulate
instrumentation supplant schematics lay out

1. With the _____ of cloud computing we quickly realized that this metered resource usage had another important management perspective – costing.

2. The field of electrical engineering has _____ into many specialized categories, such as power generation and transmission systems, batteries, digital computers and control systems.
3. The development of microcomputers and automatic technologies has greatly promoted the intelligent functions and automatization of industrial _____.
4. You can bypass this limitation by using the techniques to _____ responsive communication between the server and client.
5. If, in the next century, electronic markets begin to _____ companies as the organizing force behind economic exchange, we will confront these dilemmas anew.
6. When we _____ the power supply system of the town, we reckoned on one transformer per four blocks.
7. Subjects of the study include Ohm's law (欧姆定律), reading electrical _____, using test equipment, as well as the maintenance and troubleshooting of electrical equipment.
8. Microelectronics (微电子学), _____ and photonics play an important role in the modern optical communication and optical sensor (传感器) industry.

4 Translate the following paragraph into English.

电气工程是现代科技领域中的核心学科之一。电气工程的发达程度代表着国家的科技进步水平，因此电气工程的教育和科研一直在发达国家的大学中占据十分重要的地位。电力是发展生产和提高人类生活水平的重要物质基础，电力的应用在不断深化和发展。就目前国际水平而言，在今后相当长的时期内，电力的需求将不断增长，社会对电气工程及其自动化科技工作者的需求将呈上升态势。

Critical thinking

1 Transistors were invented in New Jersey in 1947. The invention was the culmination of a long-running effort to develop a viable alternative to the vacuum tube using semiconductor (半导体) technology. What is a transistor? Compared to vacuum tubes, what are the advantages of transistors?

2 Work in groups to discuss what the life is likely to be in the future with the rapid development of electrical engineering and its automation, and then each group gives a short report to the class.