Unit 1 A Brief Introduction of Electronic Technology

Pre-reading

Read the following passage, paying attention to the question.

1) Who invented the radio?

2) When was the real electronics started?

3) What courses should a student majoring in the electronics study?

4) What career will a student majoring in the electronic technology follow?

1.1 Text

1.1.1 History about Electronics

There can be no doubt that the 1900s is remembered as the electronic century. Of course there have been other great advances, in medicine, in transport, in science, in commerce, and many other fields, but where would they have been without the instruments and devices that electronics has provided? How would you see a 3D virtual reality image of your beating heart with no electronics? How would you get money out of the bank on a Sunday night without electronics? Would you go to a pop concert that had no amplifiers, large screens or lighting effects? Don't say you would rather watch TV – there would not be any.

Electronics in the early 20th century started thriving at a greater speed unlike the pre-20th century developments. The radio invented by the Italian genius Marconi and the work of Henry Hertz opened the road to further discoveries and inventions. In the first decade the new thing that was welcomed to the technical world was the vacuum tube. The vacuum tubes at that time worked as a miraculous component for the radio devices.

The invention of the television was a miraculous thing for the mankind. It was revolution in both communication technology and also for the world media. The distances between the continents did not seem to be far enough. The credit goes to the British engineer John Logic Baird who followed the footprints of Marconi and tried to send the images in the same way as the speech. After a long experiment he found that a series of static pictures if sent within a small interval of time in between them, seem to be moving.

The real electronics what it is called today was actually started after the discovery of the transistor effect. Transistor opened the road for the electronics and more importantly it opened the road for the computing world. Computers of various types started hitting the market and the research works got a boost.

Some other problems were also there like the assembling of the electronic components on a single mother board. Jack Kilby in Texas Instruments found a very nice solution. He suggested to

throw away all the wires and tried to connect the resistors, capacitors and transistors on the same piece of wafer internally. Surprisingly his ideas worked and gave birth to the integrated circuit industries.

1.1.2 Introduce to Some Courses

As a student majoring in the electronic technology, you will study many courses such as:

1. Direct Current Circuits & Alternating Current circuits

This course covers the fundamental theory of passive devices (resistor, capacitor and inductor) and electrical networks supplied by a DC source, and then an introduction to the effects of alternating voltage and current in passive electrical circuits is given. This module also covers DC machines, three phase machines and transformers.

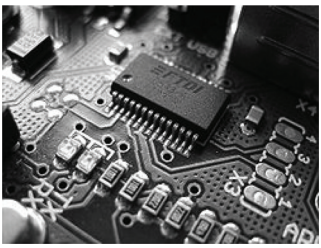

Fig 1.1 electronic circuit

2. Analog Electronics

This module introduces the characteristics of semiconductor devices in a range of linear applications and electronic circuits consisting of these devices (Fig 1.1). The following specific topics are covered. Semiconductor diodes: PN junction diodes, special purpose diodes; Transistors: field effect and bipolar transistors; Signal amplifiers: practical amplifiers, biasing circuits, operational amplifiers circuit; Other circuits: rectification, regulation and DC power supplies.

3. Digital Electronics

In this unit the following topics are covered: basic concepts about Logic circuits, number representations, combinatorial logic circuits, sequential logic circuits, introduction to CMOS digital circuits，logic operations theorems and Boolean algebra, number operations (binary, hex and integers), combinatorial logic analysis and synthesis, sequential logic analysis and synthesis, registers, counters, bus systems, CAD tools for logic design.

4. Microcontroller Systems

The use of computers and microcontrollers is now found in every field of the electronics industry. This use will continue to grow at a rapid pace as computers become more complex and powerful. The ability to program these devices will make a student an invaluable asset to the growing electronic industry. This module enables the student to program a simple microcontroller to perform typical industrial tasks. Assembler and C are used to program the MPU (Microprocessor Unit). The student will set up the internal devices such as RS232 port, timer, interrupts, counters, I/O ports, ADC etc. The program will then use these devices for control operations.

5. Computer Programming for Engineering Applications

It is a continuation of more advanced programming techniques. The language of C will be used for teaching purposes. Emphasis is towards the use of programming for engineering applications and problem solving.

The electronic technology will provide a sound educational foundation to enable graduates to

follow a career in: electrical engineering; power and control engineering; electronics; computer engineering; telecommunications engineering etc.

Technical Words and Phrases

amplifier	['æmplɪfaɪ(ə)]	*n.* [电工]扩音器，放大器
analog	['ænəlɔg]	*n.* 类似物，相似体，（计算机）模拟
career	[kə'rɪə(r)]	*n.* 事业，生涯
characteristics	[kærɪktə'rɪstɪk]	*adj.* 特有的　*n.* 特性，特征，特征值
circuit	['sə:kɪt]	*n.* 电路　*vt.* 接成电路（绕……环行）
image	['ɪmɪdʒ]	*n.* 图像，肖像，映像 *vt.* 想象，作……的像
instrument	['ɪnstrumənt]	*n.* 工具，仪器，乐器
interrupt	[ɪntə'rʌpt]	*vt.* 打断，中断　*vi.* 打断　*n.*（发给电脑的）中断信号，中断
medicine	['meds(ə)n]	*n.* 药，医学，内科学，内服药　*vt.* 给……用药
miraculous	[mi'rækjuləs]	*adj.* 奇迹的，不可思议的
module	['mɔdju:l]	*n.* 模数，模块，登月舱，指令舱，此处指课程模块
passive	['pæsɪv]	*adj.* 被动的，此处指无源的
program	['prəugræm]	*n.* 节目，程序　*vi.* 安排节目，编程序
semiconductor	[semɪkən'dʌkt]	*n.* [物]半导体
static	['stætɪk]	*adj.* 静态的，静力的
technique	[tæk'nɪ:k]	*n.* 技术，技巧，方法，表演法，手法，工艺，技艺
thrive	['θraɪv]	*v.* 兴旺，繁荣，茁壮成长，旺盛
transistor	[træn'sɪstə(r)]	*n.* [电子]晶体管；晶体管（半导体管，晶体管收音机）
virtual	['vɜ:tjuəl]	*adj.* 虚的，实质的，虚拟的，[物]有效的，事实上的

AC(alternating current)	交流电（流）
Applications	应用，应用软件
DC(direct current)	直流电（流）
electronic technology	电子技术
I/O port	输入/输出端口
major in	（在大学里）主修
pop concert	流行音乐会
power supplies	电源
the credit goes to…	归功于……

Notes to the Text

1．MPU　　Microprocessor Unit 微处理器的缩写

2．microcontroller　　微控制器，微处理器，单片机（有时用 microprocessor）

1.2 Reading Materials

1.2.1 an Advertisement

The new bachelor of engineering qualification has been designed with the needs of students and industry firmly in mind. It utilizes practical engineering examples and projects to enable students to place their knowledge in context. The degree includes the study of commercial, managerial and ethical topics as requested by the employers of professional engineers.

The faculty of Science and Engineering has a close relationship with a broad range of engineering companies. This relationship is invaluable in ensuring that the Bachelor of Engineering programmed is relevant to the present and future needs of engineering employers.

Facilities available include six computer labs including one of Australia's largest CAD/CAM Suites, electrical, electronic, telecommunications, instrumentation, mechanics, thermodynamics and pneumatics laboratories. Also available for student is a world class precision machine shop which has a wide range of up-to-date machine tools.

（这是一则国外大学的招生广告的摘录，所以它的用词十分简洁、生动。）

1.2.2 Do You Know These Electronic Systems?

Some electronic systems are familiar from everyday life. For example, we encounter radios, televisions, telephones, and computers on a daily basis. Other electronic systems are present in daily life, but are less obvious. Electronic systems control fuel mixture and ignition timing to maximize performance and minimize undesirable emissions from automobile engines. Electronics in weather satellites (Fig 1.2) provide us with a continuous detailed picture of our planet.

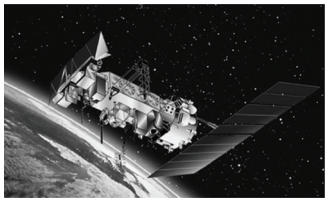

Fig 1.2　weather satellite

Still other systems are even less familiar. For example, a system of satellites known as the Global Positioning System (GPS) has been developed to provide three-dimensional information for ships, aircrafts and cars anywhere on earth. This is possible because signals emitted by several satellites can be received by the vehicle，by comparing the time of arrival of the signals and by using certain information contained in the received signals concerning the orbits of the satellites, the position of the vehicle can be determined.

Other electronic systems include the air-traffic control system, various radars, compact-disc (CD) recording equipment and players, manufacturing control systems, and navigation systems.

1.2.3 Domestic Power Plugs & Sockets

In most countries, household power is single-phase electric power, in which a single phase conductor brings alternating current into a house, and a neutral returns it to the power supply.

Domestic power plugs and sockets are devices that connect the home appliances and portable light fixtures commonly used in homes to the commercial power supply so that electric power can flow to them. Many plugs and sockets include a third contact used for a protective earth ground, which only carries current in case of a fault in the connected equipment.

Power plugs are male electrical connectors that fit into female electrical sockets. They have contacts that are pins or blades that connect mechanically and electrically to holes or slots in the socket. Plugs usually have a phase or hot or live contact, a neutral contact, and an optional earth or Ground contact. Many plugs make no distinction between the live and neutral contacts, and in some cases they have two live contacts. The contacts may be steel or brass, either zinc, tin or nickel plated.

Power sockets are female electrical connectors that have slots or holes which accept the pins or blades of power plugs inserted into them and deliver electricity to the plugs. Sockets are usually designed to reject any plug which is not built to the same electrical standard. Some sockets have one or more holes that connect to pins on the plug.

The domestic power variolls plugs and sockets used in some countries are shown in Fig 1.3.

North American
15 A/125 V grounded

Japanese 15 A/100 V

German 16 A/250 V earthed

Australian/New Zealand
10 A/240 V
& Chinese 10 A/220 V

Fig 1.3 domestic power Various Plugs & Sockets

1.2.4 More Courses

1. Signals and Systems

This unit aims to teach some of the basic properties of many engineering signals and systems and the necessary mathematical tools that aid in this process. The particular emphasis is on the time and frequency domain modeling of linear time invariant systems. The concepts learnt in this unit will be heavily used in many units of study (in later years) in the areas of communication, control, power systems and signal processing. A basic knowledge of differentiation and integration, differential equations, and linear algebra is assumed.

The following topics are covered. Continuous-time signals: classification and properties; Basic properties of systems: linearity, time-invariance, causality, and stability. Linear time-invariant (LTI) systems: characterization by differential equations (including state space formulation), and the convolution integral. Fourier series and Fourier Transform: definition, properties, frequency response and analysis of LTI systems based on Fourier transform, sampling, correlation and power spectral density; Laplace transform: definition, properties, and analysis of LTI systems based on Laplace transform, solution of state space equations using Laplace transform.

2. Circuit Theory and Design

This unit of study assumes a basic knowledge of elementary circuit theory and operational amplifiers provided by earlier units. One aim of the unit is to enhance understanding of key aspects of the theory of electric circuits. The main goal, however, is to equip students with the specialist knowledge to design active analog filters, to have an understanding of passive network design and to be in a good position to undertake further self study as required.

The specific topics covered include the following: Fundamental concepts in circuit theory: network functions, characteristic frequencies; Types of filter: lowpass, bandpass etc. Review of operational amplifiers: design of first and second order filters using operational amplifiers. cascade design. Filter characteristics: Butterworth, Chebyshev, frequency transformations in design, sensitivity design of passive LC ladder filters, a brief introduction to switched capacitor filters.

3. Control Theory

This unit is concerned with the application of feedback control to continuous-time, linear time-invariant systems. The emphasis is on fundamental theory rather than applications. Some background in linear systems theory and the Laplace transform is assumed. The prime aim of this unit of study is to develop a sound understanding of basics and a capacity for research and inquiry. Completion of the unit will facilitate progression to advanced study in the area and to work in industrial control.

The following topics are covered. History of control: Modeling of physical processes, state variables and differential equations, dynamic response, review of Laplace transform, transfer functions and block diagrams, poles and zeroes; Design specifications in the time domain: basic feedback principles, effect of feedback on sensitivity and disturbance rejection, steady state accuracy and stability, the Routh criterion, proportional integral and derivative control; Design using the root locus: rules for sketching root locus, lead and lag compensators, analogue and digital implementation of controllers; Frequency response: the Nyquist stability criterion, gain and phase margins, compensator design in the frequency domain; An introduction to state space design for single-input single-output systems: eigenvalues, zeroes and transfer functions, state variable feedback and design of estimators.

4. Communications Electronics and Photonics

This unit of study provides an introduction to the modeling and design of transmitters and receivers for electronic and optical communication subsystems. Students are expected to have a grasp of basic concepts related to electronics and circuits.

The following topics are covered: Electronic oscillators: RC, LC, crystal oscillators, tuned electronic amplifiers, frequency selectivity, feedback amplifiers; Electronic modulation and demodulation circuits: amplitude, frequency and phase modulation and demodulation, phase locked loops; Electronic mixers: high frequency, RF and microwave communication amplifiers; Photonic devices and models: semiconductor optical properties, semiconductor lasers and light emitting diodes, laser modes, output spectra, single-mode selection, distributed feedback lasers; Electro-optic modulation of light: optical amplifiers, photo detectors, avalanche photodiodes,

optical receiver front-end circuit design, basic opto-electronic link.

5. Power Electronics and Drives

This unit of study is concerned with the operating principles of DC machines and DC power control techniques with particular reference to DC machine drives. A background in basic electrical and magnetic circuit theory is assumed. Completion of this unit will facilitate progression to advanced study or work in electrical power engineering.

The following topics are covered. electrical characteristics of separately excited, series, shunt and compound generators, voltage control of generators, electrical characteristics of separately excited, series, shunt and compound motors, starting and speed control of DC motors, static switches, diode rectifiers, AC-DC converters, DC-DC switching converters, Buck, Boost and Buck-Boost converters, flyback converters.

1.3 Knowledge about Translation
（翻译知识 1——科技英语的特点）

科技英语具有下列 4 个特点。

1. 复杂长句多

科技文章要求叙述准确，用词严谨，因此一句话里常常包含多个分句，这种复杂且长的句子居科技英语难点之首，阅读翻译时要按汉语习惯来加以分析，以短代长，化难为易。

Of course there have been other great advances in medicine, in transport, in science, in commerce and many other fields, but where would **they** have been without the instruments and devices that electronics has provided? 当然在许多其他领域如医药、交通、科学、商业等行业也取得很大进步，但如果没有电子提供的仪器和器件，这些行业能取得这么大的进步吗？

这是一个带有一对并列句和一个从句组成的长句。其中 they 指的都是 great advances。

在科技英语中，要注意 it, that, which 等词的指代，有时要结合自己的专业知识来翻译。

2. 被动语态多

科技英语为了强调所论述的客观事物，常把它放在句子的首位，以突出其重要性。

The language of C **will be used** for teaching purposes. Emphasis is towards the use of programming for engineering applications and solving problem.采用 C 语言进行教学时，重点放在如何运用编程技术解决工程应用的实际问题。

在翻译中可以根据中文的习惯，不一定要译出被动语态。

The following topics are covered. 主要包括以下内容。

3. 非谓语动词多

英语每个简单句中，只能用一个谓语动词，如果有几个动词就必须选出主要动词当谓语，而将其余动作用非谓语动词形式（V-ing, V-ed ,to V 三种形式）表示，才能符合英语语法的要求。

This module enables the student **to program** a simple microcontroller **to perform** typical industrial tasks. 这个模块（教学）使学生能对一个简单的微处理器进行编程（使其）执行典型的工业任务。

这里 to program, to perform 都是非谓语动词形式描述动作。

非谓语动词也常用做定语等。

The ability **to program these devices** will make a student an invaluable asset to the **growing** electronic industry. 对日益增长的电子工业来说，一个具有微处理器编程能力的学生将会是无价的人才。

这里 to program theses devices 作定语，修饰前面的 ability; growing 作定语，修饰后面的 electronic industry。这里 asset 原意为资产、有用的东西，我们可根据上下文译成人才。

4．词性转换多

英语单词有不少是多性词，即既是名词，又可作为动词、形容词、介词或副词，字形无殊，功能各异，阅读时也很容易造成曲解。例如：light。

用做名词：	high light	强光，精华
	safety light	安全灯
用做形容词：	light industry	轻工业
	light room	明亮的房间
	light blue	淡蓝色
	light coating	薄涂层
用做动词：	light up the lamp	点灯
用做副词：	travel light	轻装旅行

因此，在翻译时要根据上下文的意思选取词意。

1.4 Exercises

1. Put the Phrases into English

① 直流电路
② 放大器（扩音器）
③ 模拟电子技术
④ 半导体二极管
⑤ 晶体管效应
⑥ 微处理器
⑦ 电气工程
⑧ 能源工程（或电力工程）
⑨ 通信工程
⑩ 内部器件

2. Put the Phrases into Chinese

① assembler language
② alternating current circuits
③ passive electrical circuits
④ three phase circuits
⑤ digital eletronics
⑥ logic gates
⑦ 3D virtual reality image
⑧ computer programming
⑨ major in
⑩ advanced programming techniques

3．Sentence Translation

① Would you go to a pop concert that had no amplifiers, large screens or lighting effects?

② The credit goes to the British engineer John Logic Baird who followed the foot prints of Marconi and tried to send the images in the same way as the speech.

③ The real electronics what it is called today was actually started after the discovery of the transistor effect.

④ Surprisingly his ideas worked and gave birth to the integrated circuit industries.

⑤ This module introduces the characteristics of semiconductor devices in a range of linear applications.

⑥ The use of computers and microcontrollers is now found in every field of the electronics industry.

⑦ This module enables the student to program a simple microcontroller to perform typical industrial tasks.

⑧ The program will then use these devices for control operations.

⑨ Emphasis is towards the use of programming for engineering applications and problem solving.

⑩ The electronic technology will provide a sound educational foundation to enable graduates to follow a career in electrical engineering.

4. Read and translate it into Chinese

① The study of electric circuits is fundamental in electrical engineering education, and can be quite valuable in other disciplines as well. The skills acquired not only are useful in such electrical engineering areas as electronics, communications, microwaves, control, and power systems but also can be employed in other seemingly different fields.

② The impact of digital integrated circuits on our modern society has been pervasive. Without them, the revolution of current computer and information-technology would not exist. Digital integrated circuits represent the most important enabling technology in this revolution. This is largely true because of the immense amount of signal and computer processing which can be realized in a single integrated circuit.

1.5 课 文 译 文

1.5.1 电子技术历史

毫无疑问，20 世纪是电子技术的世纪。当然许多其他行业如医药、交通、科学、商业等也取得很大进步，但如果没有电子技术所提供的仪器和设备，这些行业能取得这么大的进步吗？没有电子技术，你无法看到自己正在跳动的心脏的逼真的三维虚拟图像；没有电子技术，你就无法在星期日的晚上从银行取钱。你愿意去参加一个没有音响放大器、没有大屏幕或灯光效果的流行音乐会吗？不要说你宁愿在家看电视——没有电子技术也就没有电视。

与 20 世纪前不同，在 20 世纪早期，电子技术开始有了较快的发展。首先意大利天才马可尼（Marconi）发明的无线电和亨利·赫兹（Henry.Hertz）的工作为电子技术进一步的发明创造开辟了道路。在 20 世纪第一个十年中最受技术世界欢迎的新东西是真空管，在那时真空管是无线电设备中一个奇妙的器件。

对于人类来说，电视的发明也是一个奇迹。电视带来了通信技术和世界传媒的革命。有了电视，洲与洲的距离似乎不再遥远。电视的发明应归功于英国工程师约翰·罗杰克·贝尔

德（John Logic Baird），他追随马可尼（Marconi）的足迹，想用与传送声音相同的方式传送图像。经过长时间实验后，他发现如果以很短的时间间隔发送一组静态的图片，看起来就像是活动的图像。

今天所说的电子技术实际上是在发现晶体管效应以后开始（发展）的。晶体管为电子技术开辟了道路，更重要的是它为计算机世界开辟了道路。各种类型的计算机开始在市场上出现，研究工作进入一个迅速发展的时代。

在电子技术发展过程中还存在其他的问题，如电子器件在一块主板上的安装问题。对此德克萨斯仪器公司的杰克·柯比（Jack.Kilby）找到了很好的答案。他提议不用任何导线，把电阻、电容和晶体管在同一片晶片内部连接起来，令人不可思议的是他的想法成功了，从此诞生了集成电路工业。

1.5.2 一些课程介绍

作为一个电子技术专业的学生，要学习下列课程。

1．直流电路与交流电路

这门课程包括无源元器件（电阻、电容和电感）的基本理论和用直流电源供电的电路网络，接着介绍无源电路中的交流电流和交流电压的作用，这个课程模块还包括直流电机、三相电机和变压器。

2．模拟电子技术

这个课程模块介绍半导体器件在线性应用范围中的特征和由这些器件组成的电路（如图 1.1 所示），内容包括半导体二极管：PN 结二极管、特殊二极管；三极管：场效应三极管、晶体三极管；信号放大电路：实际放大电路、偏置电路、运算放大器电路；其他电路：整流、稳压、直流电压源电路。

3．数字电子技术

这个单元学习以下的内容：逻辑电路的基本概念、数字表示方法、组合逻辑电路、时序逻辑电路、CMOS 数字电路、逻辑运算定律和布尔代数、数字运算（二进制、十六进制、整数）组合逻辑电路的分析与综合、时序逻辑电路的分析与综合、寄存器、计数器、总线系统以及逻辑电路设计中的计算机辅助设计工具（软件）。

4．微处理器系统

当前，计算机及微处理器在电子工业的各个领域中应用十分广泛，随着计算机变得更加复杂和功能强大，微处理器的应用将继续快速增长。对日益增长的电子工业来说，一个具有微处理器编程能力的学生将会是无价的人才。这个模块中安排学生对一个简单的微处理器进行编程来完成工业上典型的控制任务。用汇编语言和 C 语言对微处理器进行编程时，学生将用到一些内部的器件如 RS232 接口、定时器、中断器件、计数器、输入/输出口、模/数转换器等，将利用这些器件通过编程完成控制（系统）等操作。

5．计算机编程及其在工程中的应用

该课程继续学习更高级的编程技术，教学中采用 C 语言，重点放在如何运用编程技术解决工程应用的实际问题。

电子技术专业将为毕业生打下一个牢固的基础，学生毕业后可以从事的行业有：电气工

程、电力能源和控制工程、电子技术、计算机工程、通信工程等。

1.6 阅读材料参考译文

1.6.1 招生广告

考虑到学生和工业上的需要，（我们）开设了一种新的工程学士（学位）专业。该专业利用工程实际例子和项目使学生掌握实用的知识，专业教学内容还包括专业工程师所需要的商业、管理和道德教育。

科学工程系的全体教职员与很多行业的工程公司保持着紧密的联系，这种联系保证了（我们的）工程学士学位课程安排是符合现在和未来的工程雇主（对雇佣人的）要求的（即有很好的就业前景）。

我们拥有 6 个计算机实验室，其中包括属于澳大利亚最大的 CAD/CAM 配套中心之一的实验室，以及电气、电子、通信、仪器、机械、热力学和气体力学实验室。另外还有一个配有很多最新机械仪器的世界级精密仪器车间也对学生开放。

1.6.2 你了解这些电子系统吗

有些电子系统在日常生活中很常见，例如收音机、电视机、电话、家用计算机。有些电子系统也是日常生活中常用的，但很少引起人们注意，如汽车中用电子系统来控制燃料混合和点火时间，使发动机的性能可以达到最佳，尾气排放最少；又如人造气象卫星（如图 1.2 所示）中的电子系统为我们提供地球（周围气象）的连续、详细的图像。

另有一些电子系统可能更少见，例如称为全球定位系统（GPS）的卫星系统，用于为位于地球上任何位置的船舶、飞机和汽车提供三维定位信息，当它们接收到来自几颗卫星所发射的信号后，通过比较信号到达的时间和信号中所含的卫星轨道的信息，可以确定它们自己的位置。

其他电子系统还有航空飞行控制系统、各种雷达、光盘录音设备和播放器、制造业生产控制系统和导航系统。

1.6.3 民用电源插座和插头

很多国家，民用电源是单相电源，用一根火线（相线）和一根中线将交流电送入民居。

民用电源插头和插座是用来连接家用电器和家中所用的可移动的照明设施的，使家电和照明设施可以有电源供电，有电流流过。许多插头和插座还有用来保护接地的第三个接触头（孔）。保护接地是当所接的电器设备出现（漏电）故障时引导电流流入地的。

电源插头是电气接触头（俗称公插头），可以插入电源插座（俗称母插座）。圆形或扁平形的插头插入插孔或插槽中，使它们相互接触。插头通常有相线（或火线）、中线和接地的插头。很多插头并不区分相线和中线的插头，有的插头有两个相线插头。插头可以是用钢、青铜、锌、锡或镍材料制成的。

插座是另一种电气接触器，插座上有插槽或插孔让电源插头上的圆形或扁平形的插头插入，把电源中的电能输出给插头。插座通常设计成不允许不是相同电气标准的插头插入。有些插座有一组或多组插孔。

图 1.3 给出部分国家所用的民用电源插座和插头的照片。

1.6.4 更多课程介绍

1. 信号与系统

这个单元讲解许多工程信号和系统的基本性质以及在信号和系统处理中必需的数学工具，重点放在线性时不变系统的时域和频域模型上。在这个单元中所学的概念将在以后学习的通信、控制、电力系统和信号处理等领域的许多单元中用到，学习这个单元需要具有微分、积分、微分方程和线性代数等基础知识。

主要内容包括连续时间信号：分类及性质；系统的基本性质：线性、时不变性、因果性和稳定性；线性时不变系统：由微分方程（包括状态方程）描述的特征和卷积；傅里叶级数和傅里叶变换：定义、性质、频率响应和基于傅里叶变换的线性时不变系统的分析、采样、相关性和功率谱密度；拉普拉斯变换：定义、性质和基于拉普拉斯变换的线性时不变系统的分析、用拉普拉斯变换求解状态方程。

2. 电路理论和设计

这个单元学习之前必须具备由前期课程所提供的基本电路理论和运算放大器知识。本单元的学习目标是增强对电路理论的主要方面的理解。而主要目的是：使学生掌握专业知识，可以从事有源模拟滤波器的设计，理解无源网络设计方法，为今后进一步自学打下良好的基础。

主要包括的内容有电路理论的基本概念：网络函数、特征频率；滤波器类型：低通、带通滤波器等；运算放大器的讨论：用运算放大器设计的一级、二级滤波器、电路串联（级联）设计；几种典型的滤波器：Butterworth（巴特沃斯）、Chebyshev（契比雪夫）滤波器、设计中的频率变换、无源 LC 梯形滤波器的灵敏度设计，并对开关电容滤波器做简短的介绍。

3. 控制理论

这个单元是讲授关于连续、线性时不变系统的反馈控制的应用，重点是基本的理论而不是应用。这个单元的学习要求学生具有线性系统理论和拉普拉斯变换的基础。这个单元学习的主要目的是（使学生）在基本理论和进一步研究的能力方面打下一个坚实的基础，这个单元的学习将促进学生在本领域的进一步学习和今后在工业控制行业的工作。

主要内容包括控制理论的历史；物理过程的模型化方法：状态变量和微分方程、动态响应、拉普拉斯变换的讨论、传递函数和方框图、极点和零点；时域系统的设计方法：基本反馈原理，反馈对灵敏度、抗干扰性、稳态精度和稳定性的影响、Routh（罗斯）判断准则；比例、积分和微分控制；用根轨迹法设计：根轨迹作图规则、超前和滞后补偿、模拟控制器和数字控制器的实现；频率响应：Nyquist（纳奎斯特）稳定性判据、增益裕度和相位裕度、频域的补偿设计；并介绍了单一输入/输出系统的状态方程设计方法：本征值、零点和传递函数、状态变量反馈和计算方法的设计。

4. 通信电子学和光学

本单元介绍电子和光学通信子系统的发射机和接收机的建模和设计方法，（本单元的学习）要求学生已掌握有关电子和电路的基本概念。

主要包括的内容有：电子振荡器：RC、LC、晶体振荡器、调谐电子放大器、频率选择、反馈放大器；电子调制和解调电路：幅度、频率和相位调制和解调、锁相环；电子混合器：

高频、射频和微波通信放大器；光学器件和模型：半导体光学性质、半导体激光和发光二极管、激光模态、输出光谱、单一模态选择、分布式反馈激光器；光的电子-光学调制：光学放大器、光电探测器、雪崩光敏二极管、光学接收器的前置电路设计、基本的光-电子连接。

5. 功率电子学和驱动

这个单元的学习涉及直流电机的工作原理和与直流电机驱动相关的直流功率控制技术，要求学生已学过基本的电磁场电路理论。这个单元的学习将促进学生在电力行业中的进一步学习和工作。

主要内容包括：他励、串励、并励和复励式直流发电机的电气特性、直流发电机的电压控制，分励、串励、并励和复励直流电动机的电气特性、直流电动机的启动和速度控制，静态变换，二极管整流，交流-直流转换，直流-直流变换器，Buck（巴克）、Boost（巴斯特）和巴克-巴斯特转换器，逆变转换器。