SPECIAL ENGLISH

高等学校专业英语教材

电子信息工程

专业英语教程（第4版）

Technical English Course for Electronic Information Engineering

(Fourth Edition)

☆ 任治刚　主编 ☆

電子工業出版社
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北京 · BEIJING

内 容 简 介

本书的主要目的是使读者掌握电子信息工程专业英语术语及用法，培养和提高读者阅读和翻译专业英语文献资料的能力。本书由10个主题单元组成，涵盖了电子信息领域的主要技术分支。主要内容包括电子器件、电子电路、电子系统组件、电子系统、现代数字设计、数字信号处理、语音和音频、图像和视频、嵌入式应用、电子仪器与测量等内容。每个主题单元由3篇课文、3篇阅读材料、课文词汇、课文注释和练习组成。每篇课文均有参考译文，书后附有练习参考答案、科技英语语音手册和词汇手册；为方便读者查阅，全部阅读材料的参考译文以二维码的形式附在相应文后，读者亦可通过华信教育资源网下载使用；全书配有电子教案、视频材料等教辅资源，通过华信教育资源网 www. hxedu. com. cn 免费提供给授课教师参考。

本书可以作为电子信息工程专业的专业英语教材，也可供从事相关专业的工程技术人员参考使用。

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前　言

电子信息工程是国内外飞速发展的工程领域之一。为了应对国际化竞争，大学生必须在学习阶段打下坚实的专业基础，发展全面的职业技能。“熟练运用专业英语、有效进行科技交流”是电子信息工程专业大学生的重要专业素养和必备职业技能。

为了提高学生的专业英语阅读写作能力、拓展学生对电子信息工程关键技术的认识、培养具备国际竞争力的技术人才，《电子信息工程专业英语教程(第 4 版)》[Technical English Course for Electronic Information Engineering (Fourth Edition)]充分吸收最新科技成果和英语教学成果，按照先进实用的选材原则和简明系统的组织原则，为电子信息工程专业大学生构建了一个提高英语水平和专业素养的平台。

本教程分为 10 个主题单元，涵盖了电子信息工程领域的主要技术分支。每个单元由 3 篇课文、3 篇阅读材料和单元练习组成。课文侧重展示基础理论和核心技术；阅读材料着力介绍历史沿革、实用技术和未来前景；单元练习采用完型填空、英汉互译、摘要写作的方式训练语言技能。

本教程各单元包含的具体技术内容如下：

1	电子器件	VLSI 技术、微处理器、存储器、数字时代、闪存、微控器
2	电子电路	运算放大器、低通滤波器、ADC、开关电容滤波器、DAC
3	电子系统组件	开关电源、时钟信号源、互连部件、PCB 技术、电源芯片、晶振
4	电子系统	移动电话系统、PC 系统、卫星通信系统、GPS 系统、平板电脑
5	现代数字设计	FPGA、VHDL 语言、PLD 发展史、Verilog 语言、SoC 设计
6	数字信号处理	DSP 基础、DSP 处理器、ASP 与 DSP 的对比、软件无线电、DSC 系统
7	语音和音频	高保真音频(CD)、音频压缩(MP3)、3G、网络电台
8	图像和视频	数字图像、数码相机、电视信号、VOD、视频格式、HDTV
9	嵌入式应用	内核、RTOS、设计语言、智能电话、ARM 处理器、嵌入式 OS
10	电子仪器与测量	信号源、示波器、逻辑分析仪、信号完整性、虚拟仪器

第 1～4 单元按照“器件”(device)→“电路”(circuit)→“系统”(system)的思路，全景展示了一个典型电子信息系统的构建过程。关于“器件”，我们选择了当今广泛应用的两种 VLSI 芯片——微处理器和存储器，它们是数字时代电子系统的核心。关于“电路”，我们选择了模拟电路的代表——运算放大器和滤波器，以及混合电路的代表——ADC 和 DAC，它们是数字时代电子系统的外围。众多功能电路可以构成“系统组件”(component)，我们选择了任何电子系统都离不开的“电源设备”(power supply)、“时钟信号源”(clock source)和“互连部件”(interconnect)，它们分别相当于系统的“血液”、“心脏”和“筋骨”。关于“系统”，我们选择了移动电话、个人计算机(PC)和全球定位系统(GPS)等。

第 5～6 单元聚焦两种数字电子系统核心的设计手段。一方面，可以利用 VHDL、Verilog 等硬件设计语言，在可编程的 FPGA 和 CPLD 芯片上，设计定制的数字电子系统核心。另一方面，可以利用汇编语言、C 语言等软件设计语言，在可编程的 DSP 芯片上，设计功能强大的信号处理核心。在工程实际中，这两种方式往往配合使用。

第 7～8 单元通过介绍 CD、MP3、DSC、HDTV 等具体应用，展示了电子信息工程在音频、视频、图像等多媒体领域的发展成果，同时反映出多姿多彩的设计思路和理论成就。学习本单元，有助于激发学生的创新性思维。

第 9～10 单元面向工程实际，展示了嵌入式产品形成过程的主要方面——选择芯片、选择设计语言、选择操作系统，利用仪器进行测试、验证、故障排除等。关于“芯片”，我们选择了嵌入式领域广泛使用的 ARM。关于“语言”，我们介绍了汇编语言、C 语言、C＋＋语言、Java 语言。关于“操作系统”，我们展示了“实时操作系统”(RTOS)和“嵌入式操作系统”(embedded OS)。关于“仪器测量”，我们选择了 3 件必备仪器——信号源、示波器、逻辑分析仪，并涉及了“信号完整性”(SI)问题和“虚拟仪器”(VI)应用。

在英语语言技能训练方面，本教程采用了 3 种方式——完型填空、英汉互译、摘要写作。进行“完型填空”练习，有助于雕琢语言细节——语法、词汇、固定搭配、专业术语、专业表达方法等。进行“英汉互译”练习，有助于明辨英汉语言差异、文化差异和思维方式差异，从而提高专业阅读、学术写作和科技交流的水平。进行“摘要写作”练习，有助于熟悉科技文体格式、用词特点和写作技巧，为将来写作科技论文打下良好基础。

任何语言能力的培养，必须在真实的场景中训练才会收到实效。在本教程中，各单元练习全部取材于国外大学教材、科技专著、国际会议论文、工程技术文档(芯片使用指南、用户手册、技术白皮书)、业内专家文章和著名公司网站等(详见参考文献)，以期达到“利用英语学专业、通过专业练英语”的教学目标。

为了便于学生自学，本教程提供了课文参考译文、练习参考答案。此外，本教程在附录中还提供了“科技英语语音手册”和“科技英语词汇手册”。

为了便于教师授课及丰富课堂内容，本教程配有 PowerPoint 电子讲稿、阅读材料参考译文、视频材料等教辅资料。凡使用本教程作为教材的教师，均可登录电子工业出版社华信教育资源网(www.hxedu.com.cn)注册下载，或者电话联系 010-88254531 免费获得。

为方便读者查阅，阅读材料参考译文同时以二维码的形式附在相应文后，扫描即可阅读，

译文目录：　　　　，视频材料：

目录　　　1-1　神秘的磁力　　　1-2　生命的奇迹

本教程自 2004 年 7 月出版第 1 版以来，受到了高校师生和工程技术人员的普遍认可和欢迎。这次修订是在前 3 版的基础上，充分吸取了每位读者的合理化建议，全面更新了技术内容和语言内容，并增加了附录内容。希望最新版教程更加贴近教学、科研和工程实际。

由于水平所限，书中难免有纰漏和欠妥之处。本教程的读者反馈邮箱为 teceie4e@gmail.com，欢迎各位读者不吝赐教！

编　者

使 用 说 明

为了提高教授、学习专业英语的效率，这里给出使用《电子信息工程专业英语教程》进行教学和自修的建议。

学生自学建议

正式学习前，建议通读附录。 对于没有系统学习过科技英语课程的学生，最好在学习本教程之前，将附录中的"科技英语语音手册"和"科技英语词汇手册"通读一遍。

全面理解核心学术词汇，准确记忆关键科技术语。 面对海量英语词汇，必须要有选择。那些出现频率高、词义繁多、用法灵活的词汇是突破的重点。在专业英语学习中，有两类重点词汇——"核心学术词汇"(Core Academic Words)和"关键科技术语"(Key Technical Terms)。请分别参照课文词汇表的 New Words & Expressions 部分和 Technical Terms 部分。

泛读课文内容，聚焦英文表达技巧。 在对照参考译文阅读课文的时候，不要仅限于明白大概意思就行了，要把主要精力集中于"这个中文意思，英文是怎么表达的?"在很多情况下，英文中有若干种表达方法。那么，通过做笔记、摘抄和总结的办法，就可以不断地积累各种常用的英文表达技巧。

翻译阅读材料，训练技术信息提取能力。 作为将来的工程师，显然要具备从英文技术资料中提取关键信息的能力。本教程中的阅读材料包含了丰富的技术题材。如果对于某方面内容特别感兴趣，如 GPS 系统、软件无线电或 HDTV，那么就可以尝试着翻译一下。这也是深入学习词汇、语法和文化的最好方式。

利用单元练习，进行自我测试。 本教程中的单元练习，全部来自真实的技术资料，有利于学生测试自己真实的专业英语水平。

教师授课建议

根据教学实际情况，恰当选择精讲课文及段落。 本教程的课文难度分为高、中、低三档，适用于各类型大学、各种水平学生的专业英语教学。课文的选材，既有高难度的科技专著、学术会议论文、技术手册，也有中等难度的大学教材、用户手册、技术白皮书，还有比较易懂的综述文章、科普读物。根据实际情况，教师要选择适合课堂教学的内容，作为精讲课文和精讲段落。其他课文和段落，可以安排学生课前预习或课后自学，也可以根本不去涉及。

利用英语学专业，通过专业练英语。 专业英语课程实践性很强。在课堂上，教师不但要精讲，更要精练。一段精讲课文，既可以训练学生从中快速、准确提取技术信息的阅读能力，也可以训练学生撰写摘要、模仿造句、独立作文的能力。这种"阅读"→"分析"→"写作"的教学模式，被证明是非常成功的。

适时适量引入音频、视频，丰富课堂内容，激发学习兴趣。 为了提高专业英语听说能力，可

以在课堂教学中,引入一定量的音视频材料,并设法引导学生学会利用网络进行专业英语的听说读写交流。

强调科技英语阅读写作,提高科技交流职业技能。作为将来的工程师,阅读能力和写作能力最为重要。在科技交流中,无论查询资料、进行设计,还是联系业务,都离不开阅读和写作。有效的科技交流,要求"准确"、"快速",而这种能力不经过专业训练是无法达到的。尽管出现了自动翻译软件,但实践表明:对于科技翻译,个人的语言素质依然是主导。而专业英语课程承担着训练学生科技交流职业技能的任务。

扩展阅读建议

建议参照下列"大学科技英语"教材,进一步提高、扩展运用专业英语的各方面技能。

科技交流

[1] William Sanborn Pfeiffer, Kaye E. Adkins. 大学科技英语国际交流教程. 任治刚,译. 电子工业出版社,2014.

[2] Charles W. Knisely, Karin I. Knisely. Engineering Communication. Cengage Learning, 2014.

[3] Michael Alle. The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid (2nd Edition). Springer, 2013.

论文写作

[1] John M. Swales, Christine Feak. Academic Writing for Graduate Students (3rd Edition). ELT, 2012.

[2] Robert A. Day, Barbara Gastel. How to Write and Publish a Scientific Paper (7th Edition). Greenwood, 2011.

词汇语法

[1] Alison Pohl, Nick Brieger. Technical English: Vocabulary and Grammar. Summertown Publishing, 2002.

[2] Robert A. Day, Nancy Sakaduski. Scientific English: A Guide for Scientists and Other Professionals (3rd Edition). Greenwood, 2011.

[3] Nigel A. Caplan. Grammar Choices for Graduate and Professional Writers. University of Michigan Press/ELT, 2012.

Contents

Unit 1

Electronic Devices

Lesson 1 VLSI Technology

One of the key inventions in the history of electronics, and in fact one of the most important inventions over period, was the transistor. It was invented by Bell Laboratories [1] in 1948. In short, a transistor is a device that conducts a variable amount of electricity through it, depending on how much electricity is input to it. In other words, it is a digital switch. However, unlike the vacuum tube[2], it is solid state. This means that it doesn't change its physical form as it switches. There are no moving parts in a transistor.

The advantages of the transistor over the vacuum tube were enormous. Compared to the old technology, transistors were much smaller, faster, and cheaper to manufacture. They were also far more reliable and used much less power. The transistor is what started the evolution of the modern computer industry in motion[3].

The transistor was originally a single, discrete device, which you could place individually into a circuit much like any other. Today, some special-purpose transistors are still used that way. What allowed the creation of modern processors was the invention of the integrated circuit, which is a group of transistors manufactured from a single piece of material and connected together internally, without extra wiring[4]. Integrated circuits are also called ICs or chips.

A special material is used to make these integrated circuits. While most materials either insulate from electrical flow (air, glass, wood) or conduct electricity readily (metals, water), there are some that only conduct electricity a small amount, or only under certain conditions. These are called semiconductors. The most commonly used semiconductor is of course silicon.

By careful chemical composition and arrangement, it is possible to create a very small transistor directly on a layer of silicon, using various technologies to manipulate the material into the correct form. These transistors are small, fast and reliable, and use relatively little power. The first integrated circuit was invented in 1959 by Texas Instruments[5]. It contained just six transistors on a single semiconductor surface.

After the invention of the integrated circuit, it took very little time to realize the tremendous benefits of miniaturizing and integrating larger numbers of transistors into the same integrated circuit. More transistors (switches) were required in order to implement more complicated functions. Miniaturization[6] was the key to integrating together large numbers of transistors while increasing hardware speed and keeping power consumption and space requirements manageable.

Large-scale integration (LSI) came to refer to the creation of integrated circuits that had previously been made from multiple discrete components. These devices typically contained hundreds of transistors. Early computers were made from many of these smaller ICs connected together on circuit boards

As time progressed after the invention of LSI integrated circuits, the technology improved and chips became smaller, faster and cheaper. Building on the success of earlier integration efforts, engineers learned to pack more and more logic into a single circuit. This effort became known as very large-scale integration (VLSI). VLSI circuits can contain millions of transistors.

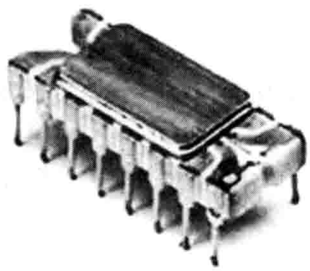

Figure 1.1 The first microprocessor-Intel 4004

Originally, the functions performed by a processor were implemented using several different logic chips. Intel[7] was the first company to incorporate all of these logic components into a single chip. This was the first microprocessor, the 4004 (Figure 1.1), introduced by Intel in 1971. All of today's processors are (highly advanced!) descendants of this original 4-bit CPU.

New Words & Expressions

device [dɪ'vaɪs] *n.* 器件

conduct [kən'dʌkt] *vt.* 传导

in motion 处于活跃状态

discrete [dɪs'kriːt] *adj.* 离散的

integrated ['ɪntɪgreɪtɪd] *adj.* 集成的

insulate ['ɪnsjʊleɪt] *vt.* 绝缘

silicon ['sɪlɪkən] *n.* 硅

manipulate [mə'nɪpjʊleɪt] *vt.* 处理

implement ['ɪmplɪmənt] *vt.* 实现

consumption [kən'sʌmpʃən] *n.* 消耗

manageable ['mænɪdʒəbəl] *adj.* 可处理的

component [kəm'pəʊnənt] *n.* 组件

incorporate [ɪn'kɔːpəreɪt] *vt.* 合并

descendant [dɪ'sendənt] *n.* 后代

Technical Terms

transistor [træn'sɪstə] *n.* 晶体管

semiconductor [ˌsemɪkən'dʌktə] *n.* 半导体

miniaturization ['mɪnɪətʃəˌraɪ'zeɪʃən] *n.* 缩微化

solid state　固态(电路)

LSI *abbr.* Large-scale Integration　大规模集成(电路)

VLSI *abbr.* Very Large-scale Integration　超大规模集成(电路)

Notes

1. Bell Laboratories 是美国的贝尔实验室。
2. "真空管"(vacuum tube)是一种内部气体全部或部分抽空的电子管。
3. 此句采用 what 引导的从句做表语，对主语"the transistor"进行强调。其意思相当于：

The transistor started the evolution of the modern computer industry in motion. 在这里，“start”为及物动词。

4. 此句采用 what 引导的从句做主语，对表语“the invention of the integrated circuit”进行强调。
5. Texas Instruments 是美国的德州仪器公司。
6. “缩微化”(miniaturization)是指减少元件和电路的几何尺寸，从而增加封装密度、降低功耗、减少信号传播延迟。
7. Intel 是美国的英特尔公司。1968 年，Robert Noyce 和 Gordon Moore 创建了英特尔公司。

Lesson 2 Memory Devices

Memories can be made in mechanical, magnetic, optical, biological and electronic technologies. Examples of magnetic memories are tapes, floppy disks, hard drives and ferroelectric[1] RAMs. Examples of optical memories are CD-ROMs, rewrittable CDs. Electronic memory is used extensively in computer equipment since it is the fastest available. For applications where speed is less important, magnetic and optical technologies are often used.

All electronic memory today can be in separate IC format, module format, or can be part of an IC as a macro-function or cell. In the table below is an overview of some electronic memory (see Table 2.1).

Table 2.1 Overview of Common Electronic Memory Devices

Type	Properties	Read/write	Non-volatile	Speed	Cost/bit
Flip-flop	One-bit register. Usually used as a basic building block in digital circuits.	Yes	No	Ultra fast	Very high
Register	Set of flip-flops holding a byte, word or long word. Used in complex chips such as CPUs.	Yes	No	Ultra fast	Very high
SRAM	Array of flip-flops that is addressable. Used for temporary storage of data or cache.	Yes	No	Very fast	High
DRAM	Array of storage cells which is addressable. Used for main computing data storage.	Yes	No	Fast	Moderate
ROM	Array of hard-wired cells that is addressable. Programming done at time of chip manufacture.	No	Yes	Very Fast	Low
EEPROM	Electrically erasable programmable ROM. Number of write cycles is limited.	Yes	Yes	Low	High

Flip-flop

A flip-flop is basically a bi-state circuit in which either a 0 or 1 state can resides. Because of its simplicity, the flip-flop is extremely fast. As a basic element, the flip-flop is used in digital circuits and ICs. A flip-flop will lose its state when the supply voltage is removed. Therefore, it is volatile.

Register

A register is a set of flip-flops in parallel. Typically a register is 8,16,32 or 64 bits wide. Often a register is used to hold data, address pointers, etc. A register is volatile and very fast just like the flip-flop.

SRAM (Static Random Access Memory)

An SRAM is an array of addressable flip-flops. The array can be configured as such that the data comes out in single bit, 4-bit, 8-bit, and etc. format. SRAM is simple, fast and volatile just like the flip-flop, its basic memory cell. SRAM can be found on microcontroller boards (either on or off the CPU chip), where the amount of memory required is small and it will not pay off to build the extra interface circuitry for DRAMs. In addition, SRAM is often used as cache[2] because of its high speed.

SRAM comes in many speed classes, ranging from several ns for cache applications to 200ns for low power applications. SRAM exists in both bipolar and MOS technology. CMOS[3] technology boasts the highest density and the lowest power consumption. Fast cache memory can be constructed in BiCMOS technology, a hybrid technology that uses bipolar transistors for extra drive. The fastest SRAM memories are available in ECL (Emitter Coupled Logic) bipolar technology. Because of the high power consumption, the memory size is limited in this technology.

A special case of SRAM memory is Content Addressable Memory (CAM)[4]. In this technology, the memory consists of an array of flip-flops, in which each row is connected to a data comparator. The memory is addressed by presenting data to it (not an address!). All comparators will then check simultaneously if their corresponding RAM register holds the same data. The CAM will respond with the address of the row (register) corresponding to the original data. The main application for this technology is fast lookup tables. These are often used in network routers.

DRAM (Dynamic Random Access Memory)

The word 'dynamic' indicates that the data is not held in a flip-flop but rather in a storage cell. The data in a storage cell must be refreshed (read out and re-written) regularly because of leakage. The refresh time interval is usually 4 to 64 ms. The storage cell only requires one capacitor and one transistor, whereas[5] a flip-flop connected in an array requires 6 transistors. In trench capacitor memory technology, which is used in all modern DRAMs, the transistor is constructed above the capacitor so that the space on chip is ultimately minimized. For this reason, DRAM technology has a lower cost per bit than SRAM technology. The disadvantage of the extra circuitry required for refreshing is easily offset by the lower price per bit when using large memory sizes.

DRAM memory is, just like SRAM memory constructed as an array of memory cells. A major difference between SRAM and DRAM, however, lies in the addressing technique. With an SRAM, an address needs to be presented and the chip will respond with presenting the data of the memory cell at the output, or accepting the data at the input and write it into the addressed cell. With DRAM technology, this simple approach is impossible since addressing a row of data without rewriting it will destruct all data in the row because of the dynamic nature.

ROM (Read Only Memory)

ROMs are also called mask [6]-ROMs or mask programmed ROMs. This is because a ROM needs to be programmed by setting its cells to either 0 or 1 at the time of manufacture. Usually the 0 or 1 is formed by the presence or absence of an aluminum line. This aluminum pattern is defined by a lithographic mask used in one of the last steps of manufacture. Therefore these devices are often called mask-ROMs.

The advantage of ROM is that it can be manufactured at the lowest price in high volumes. Another advantage in some applications is that it is impossible to alter the data once the chips are made, and that no further programming and testing are required. On the other hand, if the data or code must be changed this can be a small disaster. The rest of the chips will end in the dustbin and new chips will have to be made.

EEPROM (Electrically Erasable Programmable ROM)

This means that the chip can be programmed like an EPROM, but can be erased electrically. As a result, no UV source is required. EEPROMs can be erased on a byte-by-byte basis.

New Words & Expressions

mechanical [mɪ'kænɪkəl] *adj.* 机械的
optical ['ɒptɪkəl] *adj.* 光学的
format ['fɔːmæt] *n.* 格式
in parallel 并行的
static ['stætɪk] *adj.* 静态的
configure [kən'fɪgə] *vt.* 配置
pay off 带来利益
boast [bəʊst] *vt.* 拥有
hybrid ['haɪbrɪd] *adj.* 混合的
simultaneously [saɪməl'teɪnɪəsli] *adv.* 同时地
corresponding [ˌkɒrɪ'spɒndɪŋ] *adj.* 相应的
dynamic [daɪ'næmɪk] *adj.* 动态的
whereas [weə'æz] *conj.* 然而
approach [ə'prəʊtʃ] *n.* 方法
pattern ['pætən] *n.* 图案
alter ['ɔːltə] *vt.* 改变

Technical Terms

memory ['meməri] *n.* 存储器，内存
magnetic [mæg'netɪk] *adj.* 有磁性的