Subject-Based English

高等学校专业英语教材

电子通信
专业英语简明教程

☆任治刚 主编☆

中国工信出版集团
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Publishing House of Electronics Industry
北京 · BEIJING

内容简介

本教程由“电子信息工程专业英语”、“通信工程专业英语”和“科技英语、学术写作和职场交流”三部分构成。在技术学习方面，涵盖了电子通信领域的发展全景和众多成果。其中，电子信息工程领域包括存储器、微处理器、数字信号处理、现场可编程门阵列、MP3音频压缩、高清晰度电视机、全球定位系统等；通信工程领域包括电信系统、光纤信道、交换技术、数据通信网、通信标准、软件无线电等；在语言运用方面，介绍了科技英语的用词特点、语法要点和写作风格，阐发了学术写作的主要方法、格式和技巧，展示了应对求职、演讲等职场交流任务的建议和范例。本教程还提供了自测练习，采用完型填空、英汉互译、摘要写作的方式训练英语语言技能。为了便于教学和自修，本教程提供了课文参考译文、练习参考答案和缩略语表。对于采用本教程授课的高校教师，还可免费得到电子教案、阅读材料参考译文等教辅资源。

本教程适合电子信息工程专业和通信工程专业本科生作为专业英语教材使用，也适合相关专业的工程技术人员参考。

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前　言

面对日新月异的电子通信技术，“熟练运用专业英语、有效进行科技交流”的能力日趋重要。不论是学习新兴技术、使用新型软硬件，还是咨询技术问题、撰写学术论文，都离不开电子通信专业英语。根据教学实际需要，我们编写了本书，内容由以下三部分构成：

第一部分(第 1～10 课)是**“电子信息工程专业英语”**，反映了电子信息工程领域的众多技术成果。身处“数字时代”，任何电子信息系统都离不开各种存储器和微处理器，“闪存”和“微控器”就是这两类重要部件的典型代表。为了实现高速信息处理，设计人员需要使用“数字信号处理器”(DSP)和“现场可编程门阵列”(FPGA)这两大类处理引擎。在强大器件和高超算法的支持下，不论是“全球定位系统”(GPS)、3G 移动通信系统，还是 MP3 播放系统、“高清晰度电视”(HDTV)系统，实现起来都不再困难。在这一部分，读者会看到上述内容的精彩展示。

第二部分(第 11～20 课)是**“通信工程专业英语”**，展示了通信工程领域的发展全景和技术亮点。利用精心设计的“系统”(system)经由某种物理形式的“信道”(channel)将特制的“信号”(signal)准确无误、快速高效地传递到全球各个角落，这是通信技术工程师的职责。这就要求对信号、系统、信道、交换、网络等通信要素和环节能够深刻理解、灵活运用。在这一部分，读者会看到“双音多频信号”(DTMF)、“光纤信道”、“交换技术”、“数据通信网”、“通信标准”等经典通信技术内容。

第三部分(第 21～30 课)是**“科技英语、学术写作和职场交流”**。与日常英语相比，“科技英语”(Scientific English)的用词、语法和写作风格都有特殊之处，了解这些特点对于学好专业英语课程是大有裨益的。掌握“学术写作”(Academic Writing)的要领，为读者将来从事技术工作、发表科研论文打下了坚实的语言基础，铺平了走向行业专家的道路。此外，针对读者在求职、面试、当众演讲、撰写电子邮件等方面的实际需求，“职场交流”(Workplace Communication)提供了实用建议和参考范例。熟悉本部分内容并适时实践，将有助于读者的留学、深造以及任职于国际化企业。

除课文外，本书还提供了“练习”和“阅读材料”。“练习”采用完型填空、英汉互译、摘要写作的方式训练英语语言技能。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坚实基础。书中课文、自测练习和阅读材料全部取材于大学教材、科技专著、国际会议论文、工程技术文档、业内专家文章和著名公司网站(详见参考文献)，并且经过了合理的增删、组合和润色，以期更好地实现“利用英语学专业、通过专业练英语”的教学目标。

为了方便教师授课和学生自修，本书提供了全部课文的参考译文、练习参考答案，在附录中还提供了“科技翻译基础”、“学术写作精要”、“当众讲演用语”、“数学表达式读法”和“IEEE 规范缩略语”。对于采用本书授课的教师，可以通过登录电子工业出版社“华信教育资源网”

(www.hxedu.com.cn)或者电话联系 010-88254531 免费得到电子教案、阅读材料参考译文等教辅资源。

总之，本书构成了一个简明、实用的“电子通信专业英语”教学平台，完全可以满足众多院校的切实需求。其主要特色如下：

(1) **结构完整、统一、清晰、合理。**全书采用统一的结构，分为三大部分，每部分包括 10 篇课文、3 篇阅读材料和 1 个自测练习。

(2) **各部分内容自成体系又相互照应和补充。**“电子信息工程”和“通信工程”是两个联系密切而又各具特色的 IT 专业。本书将二者明确划分为两部分：“电子信息工程专业英语”部分按照“核心器件”→“实现方法”→“应用系统”进行组织；“通信工程专业英语”部分按照“信号(收/发端)”→“系统(信道)”→“网络(交换)”进行组织。在具体内容上，二者又相互照应和补充(如 GPS 系统、3G 等)。第三部分“科技英语、学术写作和职场交流”不仅为前两部分提供了支持，而且进行了拓展。

(3) **英语语言难度适中，技术内容可读性强、图文并茂。**所选文章的可读性是保证专业英语教学效果的关键。技术内容过于滞后、超前、艰深或偏狭，都不利于教师备课，也不利于学生预习。在文章遴选上，本书尽量保证学生利用既有专业知识能够理解课文内容，并使学生通过学习加深、扩展相关专业知识。为了增强可读性，本书对部分文章的局部内容进行了文字加工，并增加了恰当的表格或图片。

(4) **学习资源全面，方便教师备课、学生备考以及职场人士自修。**每篇课文对应的词汇表分类明晰、注音完整(采用最新版 IPA 音标)、释义准确，课文注释恰当。完整的课文参考译文、自测练习答案、阅读材料参考译文，为教学和自修提供了方便。

由于编者水平所限，书中难免有纰漏和欠妥之处，读者反馈邮箱为 ccpet1e@gmail.com，欢迎各位读者不吝赐教！

编　者

使用说明

为了提高教学效率，这里给出使用本书的若干建议。

学生自学建议

正式学习前，建议通读“科技英语”部分。对于没有系统学习过“大学科技英语”课程的学生，最好在学习本教程之前，将第三部分中的“科技英语用词特点”(第21课)、“科技英语语法要点”(第22课)、“科技英语写作风格”(第23课)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，聚焦英语表达方法。在对照参考译文阅读课文时，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，英语中有若干种表达方法。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语表达技巧。

翻译阅读材料，训练信息提取能力。作为将来的工程师，显然要具备从英文资料中提取关键技术信息的能力。本书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，那么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。

利用自测练习，进行自我测试。本书中的自测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。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，也可以根本不涉及。

利用英语学专业，通过专业练英语。在课堂上，一段精讲课文，既可以用来训练学生从中快速、准确提取技术信息的阅读能力，也可以用来训练学生撰写摘要、模仿造句、独立作文的能力。

适时适量引入音视频材料，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，阅读和写作能力十分重要，因为在科技交流中，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具备的。

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] W S 法伊弗，K E 阿德金斯. 大学科技英语国际交流教程[M]. 北京：电子工业出版社，2015.

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

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

论文写作

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

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

词汇语法

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

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

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

Contents

PART 1

Technical English for Electronic Information Engineering

Lesson 1 The Digital Age

The Analog Age

Up until the middle of the 20th century, the technology designed by engineers was primarily analog; more specifically, the devices[1] and systems that engineers created relied primarily upon physical forces and matter for their basic operation rather than[2] some abstract quantity, such as numbers.

For example, analog audio records introduced in the first part of the 20th century use the physical bumps and indentations in the grooves on vinyl discs[3] (albums) to store audio data. The stylus at the end of the tone arm of a turntable rides in these grooves and vibrates[4] nearly identically to the original sound waves of the audio. This mechanical motion is then converted to an identical[5] electrical version of the audio that is subsequently amplified and played through speakers. The entire process of re-creating audio from bumps and indentations is purely physical. Never is the sound waveform converted to numbers to be stored or manipulated; in other words, the system is analog.

Analog systems liketurntables and albums are quite functional. However, like all designs, they suffer from a number of shortcomings:

- Analog systems can be large.
- Analog systems can consume lots of energy.
- Analog systems are not easily modified to solve new or different tasks.
- Analog systems are prone to breakdowns due to their physical operation.

Building Blocks for Analog Designs

Early electronic technology was built using an important analog device called a vacuum tube. Such tubes were used to control the electrical current and voltage in systems such as radios, radar, and very early computers. Unfortunately, like light-bulbs, these vacuum tubes got very hot, and burned out regularly. Your older family members might remember how often TVs used to break down due to[6] vacuum tubes burning out.

The Birth of the Digital Age

During the middle of the 20th century, mathematicians and engineers discovered a process for converting most physical quantities found in the world (such as sound waves, light intensity, forces, voltage, current, or charge) to numbers or digits. This discovery should not be surprising, since scientists had been using mathematics to describe the physical world for centuries. This remarkable, yet simple, discovery was the mathematical foundation that gave birth to the digital age.

There are many advantages to "digitizing" analog quantities. For example:

- Numbers are much less sensitive to physical problems caused by the physical nature of the device used to store or manipulate them.
- Numbers are easier to store than an equivalent physical "amount" of something.
- Numbers can be moved through space, using electronic, optical, or acoustic means.

To illustrate these advantages, let's revisit the recreation of audio systems as discussed earlier in this section. Unlike analog systems, today the sounds of most audio are converted to numbers at the recording studio and stored on a compact disc (CD) or DVD. A CD player simply reads the numbers from the CD and then converts these numbers back to the original audio. If you have ever compared the quality of audio between an average turntable and an average CD player, you should have little doubt that digital technology is significantly better than the earlier analog technology.

Also, can you imagine trying to jog or walk with a turntable strapped to your waist or inside your backpack? Table 1.1 lists some analog devices and the corresponding digital devices. Which do you prefer to use?

Table 1.1 Analog devices vs. digital devices

Analog Devices	Digital Devices
LPs	CDs
Film cameras	Digital cameras
Dial watches	Digital watches
Standard TV	HDTV
VHS camcorders	Digital camcorders

Still a Long Way To Go

Unfortunately, there was a major problem in building new digital devices when they were first conceived. Engineers just didn't have the right parts to build new digital systems. Not to be deterred, engineers working during the first half of the 20th century tried the smart and reasonable thing: They attempted to use readily available vacuum tubes as basic digital building blocks. Following this approach, in 1945, engineers successfully produced the first digital computer, called the ENIAC (Figure 1.1). It was built out of more than 17,000 vacuum tubes, weighed 30 tons, and filled a 30-by-50-foot room. Just think of the heat produced by 17,000 light-bulbs all burning in the same room!

While primitive by today's standards, the ENIAC was a major advance in engineering and technology. Never before in human history could we do math so fast and so accurately. While the ENIAC opened up new digital horizons for society, these first computers were so large and so expensive that only governments and the largest of companies could ever hope to own or even use one.

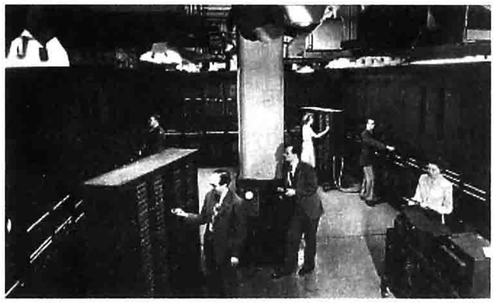


Figure 1.1 The first digital computer-ENIAC-produced in 1945

The Transistor Replaced the Vacuum Tube

What the digital age needed was a truly digital component that could replace the vacuum tube. It would have to run fast, use much less power than the vacuum tube, and, most importantly, be small and inexpensive.

Fortunately, in 1947 engineers at AT&T's Bell Laboratories developed that component, called the transistor (Figure 1.2). Its creation changed the world forever. Bill Shockley, Walter Brattain, and John Bardeen[7] won the Nobel Prize in 1956 for their joint discovery and development of the transistor, which, within a few decades, had completely replaced the vacuum tube in nearly every piece of technology.

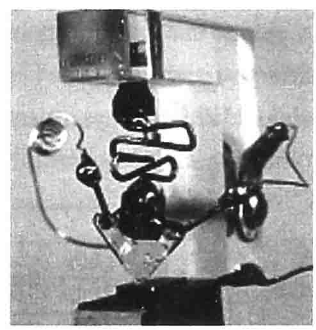


Figure 1.2 The first transistor

Now, engineers could unleash their imaginations to create smaller, portable devices that could run on the relatively small amounts of energy contained in batteries and were rugged in normal use. For this reason, many people believe that the transistor is the most important invention of the 20th century. Just look around you today to see the nearly infinite[8] array of small gadgets and pieces of technology built from transistors.

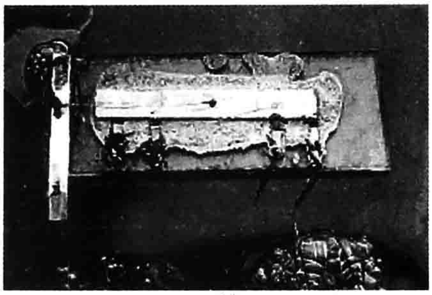
The Integrated Circuit (IC)

As engineers designed devices for more complex tasks, such as in robotics or medicine, the resulting systems required ever more transistors. This push for more transistors made the devices large and hard to wire together.

The next critical step forward into the digital age was the ability to put many transistors onto a single small part that could be used for these increasingly complex tasks. Jack Kilby[9] accomplished this remarkable feat in 1958 at Texas Instruments when he invented the integrated circuit, or IC, as shown in Figure 1.3(a).

For this discovery, Kilby was awarded the 2000 Nobel Prize in physics. This groundbreaking invention was coined the "integrated circuit" because it cleverly integrated many parts, typically transistors, into a single small package like that shown in Figure 1.3(b).

With the invention of the IC, engineers were able to undertake more complicated designs, because they now had modern digital parts that could do significantly more complicated math on the newly digitized version of the real analog world. Interestingly, the integrated circuit has become so pervasive in devices from computers to anti-lock brakes that it is difficult to find individual transistors in modern technology today — they are now all part of integrated circuits.



(a)

(b)

Figure 1.3 (a) The first integrated circuit produced by Jack Kilby (b) A modern integrated circuit

New Words & Expressions

vinyl [ˈvaɪnl] *n.* 乙烯基
album [ˈælbəm] *n.* 唱片
stylus [ˈstaɪləs] *n.* 唱针
bump [bʌmp] *n.* 凸起
indentation [ɪndenˈteɪʃən] *n.* 凹陷
groove [gruːv] *n.* 凹槽
device [dɪˈvaɪs] *n.* 设备
identical [aɪˈdentɪkəl] *adj.* 完全相同的
quantity [ˈkwɒntəti] *n.* 量
consume [kənˈsjuːm] *vt.* 消耗
modify [ˈmɒdɪfaɪ] *vt.* 调整
vibrate [vaɪˈbreɪt] *vi.* 振动
manipulate [məˈnɪpjʊleɪt] *vt.* 处理
conceive [kənˈsiːv] *vt.* 设想
unleash [ʌnˈliːʃ] *vt.* 发挥
acoustic [əˈkuːstɪk] *adj.* 声音的
camcorder [ˈkæmkɔːdə] *n.* 便携式录像机
robotics [rəʊˈbɒtɪks] *n.* 机器人技术
accomplish [əˈkʌmplɪʃ] *vt.* 完成
give birth to… 产生……
equivalent [ɪˈkwɪvələnt] *adj.* 等价的
component [kəmˈpəʊnənt] *n.* 部件
infinite [ˈɪnfɪnət] *adj.* 无限的
array [əˈreɪ] *n.* 阵列
integrate [ˈɪntɪˌgreɪt] *vt.* 集成
rugged [ˈrʌgɪd] *adj.* 结实耐用的
gadget [ˈgædʒɪt] *n.* 小用具
groundbreaking [ˈgraʊndbreɪkɪŋ] *adj.* 全新的
undertake [ʌndəˈteɪk] *vt.* 开展
pervasive [pəˈveɪsɪv] *adj.* 遍布的

Technical Terms

analog [ˈænəlɒg] *adj.* 模拟的
digital [ˈdɪdʒɪtəl] *adj.* 数字的
audio [ˈɔːdɪəʊ] *adj.* 音频的
amplify [ˈæmplɪˌfaɪ] *vt.* 放大

speaker [ˈspiːkə] *n.* 扬声器
voltage [ˈvəʊltɪdʒ] *n.* 电压
current [ˈkʌrənt] *n.* 电流
charge [tʃɑːdʒ] *n.* 电荷
transistor [trænˈzɪstə] *n.* 晶体管
battery [ˈbætəri] *n.* 电池
package [ˈpækɪdʒ] *n.* 封装
building block 构成模块
electronic technology 电子技术
vacuum tube 真空管
LP *abbr.* Long Playing 密纹唱片
CD *abbr.* Compact Disc 光盘
DVD *abbr.* Digital Video Disk 数字视频光盘
VHS *abbr.* Video Home System 家庭录像系统
HDTV *abbr.* High-Definition Television 高清晰度电视
IC *abbr.* Integrated Circuit 集成电路
radar [ˈreɪdɑː] *abbr.* radio detection and ranging 无线电探测和测距(雷达)

Notes

1. device 和 component 都属于电子通信专业常用词汇。device 可译作"器件"或"设备",如"存储器件"(memory devices)、"便携设备"(portable devices)等。component 可译作"组件"或"部件",如"系统组件"(system components)、"核心部件"(core components)等。component 还可表示数学中的"分量"、化学中的"组分"、机械设计中的"零件"等。

2. 结构 *rather than* … 表示"代替……"、"而不是……",可以连接单词、短语或从句。例如,"向他人解释概念时,多数人口头表达比书面表达的思路更清晰。"(Most of us can think more clearly if we have to explain a concept to another person in verbal rather than in written form.)

3. 在这里,vinyl disc 特指早期含有乙烯基材质的黑胶唱片。

4. vibrate 指"机械振动",易混词有 fluctuate(波动)、oscillate(振荡)、resonate(谐振)和 vacillate(摆动)。

5. identical 不同于 equivalent。identical 表示"完全一样的",而 equivalent 则表示"等值的"、"等量的"或"等效的"。例如,"和等值物理量相比,数字更容易存储"(Numbers are easier to store than an equivalent physical "amount" of something);"机械振动转换为同样的电信号,经放大后由扬声器播放出来"(This mechanical motion is then converted to an identical electrical version of the audio that is subsequently amplified and played through speakers)。

6. 结构 *due to*…表示原因,其功能与 *owing to*…或 *because of*…相同。例如,"因为景色亮度在变化,为使整体画面质量良好,就需要控制电荷耦合器件的曝光量。"(Due to varying scene brightness, to get a good overall image quality, it is necessary to control the exposure of the CCD.)

7. 1945年，以比尔·肖克利(Bill Shockley)、沃特·布拉顿(Walter Brattain)和约翰·巴丁(John Bardee)为核心的"贝尔实验室"(Bell Laboratories)半导体研究小组发明了"晶体管"(transistor)。1956年，他们获得诺贝尔物理学奖。

8. infinite意为"无限的"，其反义词是finite(含义为"有限的"，发音为['faɪ,naɪt])。例如："有限冲激响应"(FIR, Finite Impulse Response)和"无限冲激响应"(IIR, Infinite Impulse Response)。

9. 1958年，杰克·基尔比(Jack Kilby)进入"德州仪器公司"(Texas Instruments)工作，同年发明了第一片集成电路。2000年，杰克·基尔比获诺贝尔物理学奖。

Lesson 2 The Flash Memory

Electronic memory comes in a variety of forms to serve a variety of[1] purposes. Flash memory is used for easy and fast information storage in such devices as digital cameras and home video game consoles. It is used more as a hard drive than as RAM. In fact, Flash memory is considered a solid state storage device. Solid state means that there are no moving parts-everything is electronic[2] instead of mechanical.

Here are a few examples of Flash memory:

- Your computer's BIOS chip.
- Compact Flash[3] (most often found in digital cameras).
- Smart Media[4] (most often found in digital cameras).
- Memory Stick[5] (most often found in digital cameras).
- PCMCIA Type I and Type II memory cards (used as solid-state disks in laptops).
- Memory cards for video game consoles.

Flash memory is a type of EEPROM chip. It has agrid of columns and rows with a cell that has two transistors at each intersection. The two transistors are separated from each other by a thin oxide layer. One of the transistors is known as a floating gate, and the other one is the control gate. The floating gate's only link to the row, or wordline, is through the control gate. As long as this link is in place, the cell has a value of 1. To change the value to a 0 requires a curious process called Fowler-Nordheim tunneling[6] (see Figure 2. 1).

Tunneling is used to alter the placement of electrons in the floating gate. An electric charge, usually 10 to 13 volts, is applied to the floating gate. The charge comes from the column, or bitline, enters the floating gate and drains to a ground.

This charge causes the floating-gate transistor to act like an electron gun. The excited electrons are pushed through and trapped on other side of the thin oxide layer, giving it a negative charge. These negatively charged electrons act as a barrier between the control gate and the floating gate. A special device called a *cell sensor* monitors the level of the charge passing through the floating gate. If the flow through the gate is greater than 50 percent of