“十三五”普通高等教育规划教材

工程学科英语

第二版

乔小六　主编

Engineering Discipline English
(2nd Edition)

中国电力出版社
CHINA ELECTRIC POWER PRESS

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主　编　乔小六
副主编　龚玲莉　孙梓健

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内 容 提 要

本书为“十三五”普通高等教育规划教材，是《工程学科英语》修订版。全书共十个单元，内容涵盖工程学科概论、工程科技回顾与展望、大数据技术、虚拟现实技术、人工智能、加料制造、智能电网、物联网技术、城市规划、工业和建筑设计。每个单元主要由 Warm-up Task，Focus Reading，Focus Listening，Watching & Speaking 构成，听、说、读、写、译等能力训练贯穿整个单元。本书附光盘一张，内容为本书配备的音频和视频。

本书适用于英文基础较好的工程专业本科或专科学生、工程专业硕士，以及从事工程学科领域教学和研究的工作人员。

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前言

大学英语是高等教育的一个有机组成部分，是大学生一门必修基础课程。中国大学英语教学完成了从结构语言学向认知语言学语境的转向，成绩有目共睹；但中国大学外语教学正经历新的危机，根源就是大学英语教学和专业人才培养的断裂。大学英语教学并不是一个独立的体系，它是专业人才培养体系的亚体系，必须呼应学习目标、专业指向的个性化诉求。

“卓越工程师大学外语”系列教材是为适应我国高等教育发展，工程人才培养和大学外语教学改革需要而开发。该系列教材是我们多年思考和实践的成果，分为“外语技能提升”“工程文化拓展”“工程学科认知”三大类。“外语技能提升”类主要针对学生听、说、读、写、译等单项技能培养，密切关注社会等级考试和外语能力证书考试。“工程文化拓展”类目的是拓展学生的国际视野，培养学生跨文化意识，密切关注时事背后的文化动因。“工程学科认知”类以专业学科为基础，培养学生以国际的眼光认知所从事的学科和基本学术规范。

《工程学科英语》着眼于培养学生国际化的视野下工程学科基本认知能力，是通用英语向专业英语的过渡。在第二版中增加了工程学科最新发展和前瞻性内容，同时引导学生领会工程领域国际企业文化，提升了教材的学术内涵。本书适用于英文基础较好的工程专业本科或专科学生、工程专业硕士，以及从事工程学科领域教学和研究的工作人员。

本书由天印外语教育工作室组织编写，是教育部重点课题“卓越计划视野下的大学英语教学改革”（GPA11051）阶段性成果。本书力求探索全新教学模式，不妥之处，敬请各位同行和使用者批评指正。

乔小六

2016 年 10 月于金陵

第一版前言

大学英语是高等教育的一个有机组成部分，是大学生一门必修基础课程。中国大学英语教学完成了从结构语言学向认知语言学语境的转向，成绩有目共睹；但中国大学外语教学正经历新的危机，根源就是大学英语教学和专业人才培养的断裂。大学英语教学并不是一个独立的体系，它是专业人才培养体系的亚体系，必须呼应学习目标、专业指向的个性化诉求。

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《工程学科英语》突破特殊用途英语（ESP）、学术英语（EAP）和职业用途英语（EOP）范畴，着眼于培养学生国际化视野下工程学科基本认知能力，是通用英语向专业英语的过渡。本教材适用于已经通过大学英语四级考试的工程专业本科学生，建议修读学期为第四学期。

本教材由天印外语教育工作室组织编写，是教育部重点课题“卓越计划视野下的大学英语教学改革”（GPA11051）阶段性成果。本书力求探索全新教学模式，不妥之处，敬请各位同行和使用者批评指正。

乔小六

2014 年 12 月于金陵

目　录

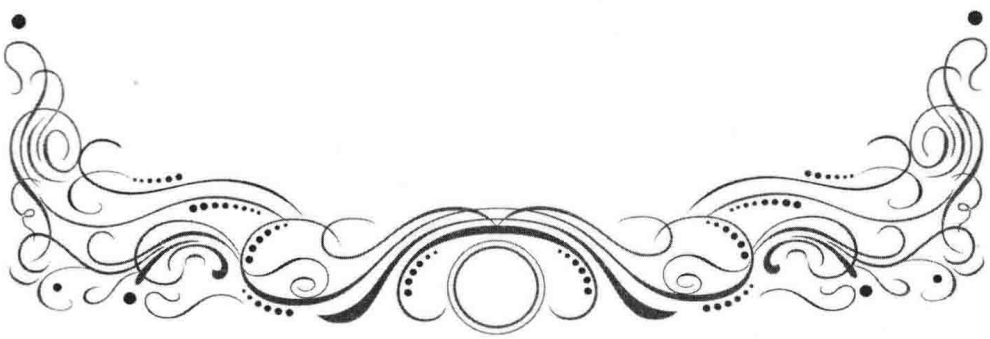
Scientists investigate that

which already is;

Engineers Create that

which has never been.

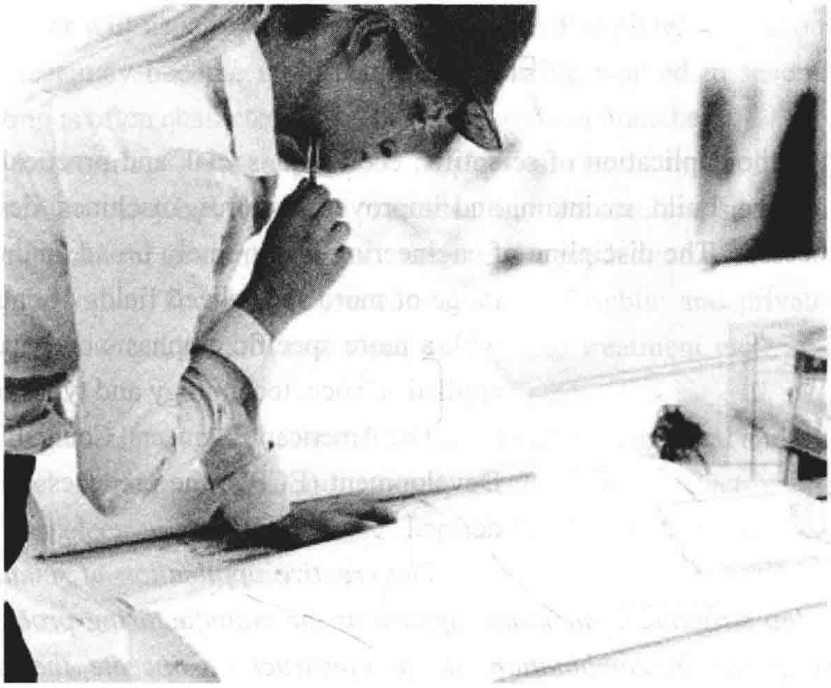
By Albert Einstein



Stephen (or Stephan) Gary Wozniak (斯蒂夫·盖瑞·沃兹尼亚克) (born August 11, 1950), known as "Woz", is an American inventor, electronics engineer, and computer programmer who co-founded Apple Computer (now Apple Inc.) with Steve Jobs and Ronald Wayne. Wozniak single-handedly designed both the Apple I and Apple II computers in the late 1970s. These computers contributed significantly to the microcomputer revolution.

Unit One

Understanding Engineering



Warm-up Task

Directions: *Watch a short video and complete the outline.*

Name of the glove: _____

Birthplace of the glove: _____

Functions of the glove: _____

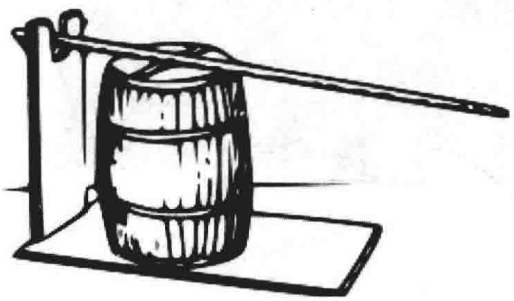
How it works: _____

Part One Focus Reading

Passage 1

Engineering

Engineering is the application of scientific, economic, social, and practical knowledge in order to invent, design, build, maintain, and improve structures, machines, devices, systems, materials and processes. The discipline of engineering is extremely broad, and encompasses a range of more specialized fields of engineering, each with a more specific emphasis on particular areas of applied science, technology and types of application.



The American Engineers' Council for Professional Development (ECPD, the predecessor of ABET) has defined "engineering" as:

The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation or safety to life and property.

Engineering has existed since ancient times as humans devised fundamental inventions such as the wedge, lever, wheel, and pulley. Each of these inventions is consistent with the modern definition of engineering, exploiting basic mechanical principles to develop useful tools and objects.

The term *engineering* itself has a much more recent etymology, deriving from the word *engineer*, which itself dates back to 1300, when an *engine'er* (literally, one who operates an *engine*) originally referred to "a constructor of military engines." In this context, now obsolete, an "engine" referred to a military machine, *i.e.*, a mechanical contraption used in war (for example, a catapult). Notable examples of the obsolete usage which have survived to the present day are military engineering corps, *e.g.*, the U.S. Army Corps of Engineers.

The word "engine" itself is of even older origin, ultimately deriving from the Latin

ingenium, meaning "innate quality, especially mental power, hence a clever invention."

Later, as the design of civilian structures such as bridges and buildings matured as a technical discipline, the term civil engineering entered the lexicon as a way to distinguish between those specializing in the construction of such non-military projects and those involved in the older discipline of military engineering.

Engineering is a broad discipline which is often broken down into several sub-disciplines. These disciplines concern themselves with differing areas of engineering work. Although initially an engineer will usually be trained in a specific discipline, throughout an engineer' s career the engineer may become multi-disciplined, having worked in several of the outlined areas. Engineering is often characterized as having four main branches:

Chemical engineering – The application of physics, chemistry, biology, and engineering principles in order to carry out chemical processes on a commercial scale, such as petroleum refining, microfabrication, fermentation, and biomolecule production.

Civil engineering[1] – The design and construction of public and private works, such as infrastructure (airports, roads, railways, water supply and treatment etc.), bridges, dams, and buildings.

Electrical engineering[2] – The design and study of various electrical and electronic systems, such as electrical circuits, generators, motors, electromagnetic/electromechanical devices, electronic devices, electronic circuits, optical fibers, optoelectronic devices, computer systems, telecommunications, instrumentation, controls, and electronics.

Mechanical engineering[3] – The design of physical or mechanical systems, such as power and energy systems, aerospace/aircraft products, weapon systems, transportation products, engines, compressors, powertrains, kinematic chains, vacuum technology, and vibration isolation equipment.

Beyond these four, sources vary on other main branches. Historically, naval engineering and mining engineering were major branches. Modern fields sometimes included as major branches include manufacturing engineering, acoustical engineering, corrosion engineering, Instrumentation and control, aerospace, automotive, computer, electronic, petroleum, systems, audio, software[4], architectural, agricultural, biosystems, biomedical, geological, textile, industrial, materials, and nuclear engineering. These and other branches of engineering are represented in the 36 institutions forming the membership of the UK Engineering Council.

New specialties sometimes combine with the traditional fields and form new branches - for example Earth Systems Engineering and Management involves a wide range of subject areas including anthropology, engineering, environmental science, ethics and philosophy. A new or emerging area of application will commonly be defined temporarily as a permutation or subset of existing disciplines; there is often gray area as to when a given sub-field becomes large and/or prominent enough to warrant classification as a new "branch." One key indicator of such emergence is when major universities start establishing departments and programs in the new field.

For each of these fields there exists considerable overlap, especially in the areas of the application of sciences to their disciplines such as physics, chemistry and mathematics.

The study of failed products is known as forensic engineering, and can help the product designer in evaluating his or her design in the light of real conditions. The discipline is of greatest value after disasters, such as bridge collapses, when careful analysis is needed to establish the cause or causes of the failure.

Words & Expressions

1. discipline *n.* 学科
2. encompass *v.* 围绕，包围；包含或包括某事物
3. a range of 一系列；一些；一套
4. predecessor *n.* 前任，前辈；原有事物，前身；<古>祖先
5. apparatus *n.* 仪器，器械
6. utilize *v.* 利用，使用
7. wedge *n.* 楔；楔形物；（击高尔夫球的）楔形铁头球棒
8. lever *n.* 杠杆；操作杆；工具
9. pulley *n.* 滑轮（组），滑车；皮带轮
10. be consistent with 与…保持一致
11. etymology *n.* 词源学，词源说明
12. derive from 由…起源，源于
13. date back to 追溯到…，由…开始
14. obsolete *adj.* 废弃的；老式的，已过时的
15. contraption *n.* 奇妙的装置，新发明
16. catapult *n.* 弹弓；石弩；飞机弹射器；弹射座椅
17. innate *adj.* 天生的；特有的，固有的；内在的，直觉的
18. lexicon *n.* 词典；专门词汇
19. specialize in 专攻，精通，以…为专业；专修
20. scale *n.*规模, 级别
21. petroleum refining 石油加工
22. microfabrication *n.* 微细加工
23. fermentation *n.* 发酵
24. biomolecule *n.* 生物分子
25. circuit *n.* 电路
26. generator *n.* 发电机
27. electromagnetic *adj.* [物] 电磁的
28. electromechanical *adj.* 电动机械的，机电的，电机的
29. optical fibers 光导纤维
30. optoelectronic *adj.* 光电子的

31. compressor *n.* 压气机，压缩机
32. powertrain 动力系统
33. kinematic *adj.* 运动学的，运动学上的
34. acoustical *adj.* 听觉的，声学的
35. corrosion *n.* 腐蚀，侵蚀，锈蚀
36. anthropology *n.* 人类学
37. permutation *n.*（一组事物可能的一种）序列
38. warrant *v.* 保证，担保；授权
39. overlap *n.* 重叠部分
40. forensic *adj.* 法庭的，法院的；公开辩论的，论争的；适于法庭的

Notes

1. Civil engineering, considered one of the oldest engineering disciplines, encompasses many specialties. The major ones are structural, water resources, construction, transportation, and geotechnical engineering. Many civil engineers hold supervisory or administrative positions, from supervisor of a construction site to city engineer. Others may work in design, construction, research, and teaching.

土木工程是最古老的工程学科之一，它包括许多专业，主要有结构、水利、建筑、交通和地质技术工程。许多土木工程师任职于各种监管或管理岗位，如建筑工地监理人员和城市规划工程师。还有一些可能从事设计、建造、研究和教学工作。

Civil engineering is grouped into seven specialty areas: structural, environmental, geotechnical, water resources, transportation, construction, and urban planning. In practice, these are not always hard and fixed categories, but they offer a helpful way to review a very diverse and dynamic field.

土木工程可以分为七个专业领域：结构、环境、地质技术、水利、交通、建筑和城市规划。在实践中，这并非完全固定不变的分类，但这种分类有助于了解土木工程这个多样化且不断变化的领域。

Civil engineers design and supervise the construction of roads, buildings, airports, tunnels, dams, bridges, and water supply and sewage systems. They must consider many factors in the design process from the construction costs and expected lifetime of a project to government regulations and potential environmental hazards such as earthquakes and hurricanes.

土木工程师对道路、建筑物、机场、隧道、大坝、桥梁的建造及供水、排污系统进行设计和监管。在设计过程中，他们必须考虑多种因素，如建造成本、项目的预期寿命、政府的法规和潜在的地震、飓风等自然灾害。

2. Electrical engineering is a field of engineering that generally deals with the study and application of electricity, electronics, and electromagnetism. This field first became an identifiable occupation in the latter half of the 19th century after commercialization of the electric telegraph, the telephone, and electric power distribution and use. Subsequently,

broadcasting and recording media made electronics part of daily life. The invention of the transistor and, subsequently, the integrated circuit brought down the cost of electronics to the point where they can be used in almost any household object.

电气工程通常是关于电力、电子、电磁研究和运用的工程领域。19 世纪下半叶电报、电话及电力的分配和使用实现了商业化之后，该领域才第一次被确认为一个行业。随后，广播和录音设备使得电子技术成为日常生活的一部分。晶体管的发明和其后出现的集成电路降低了电子器件的成本，使得几乎所有的家庭物品现在都可以使用电子器件。

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment. Some of this equipment includes electric motors; machinery controls, lighting, and wiring in buildings; radar and navigation systems; communications systems; and power generation, control, and transmission devices used by electric utilities. Electrical engineers also design the electrical systems of automobiles and aircraft.

电气工程师从事电气设备的设计、开发和测试，并监管电气设备的制造。部分电气设备包括：电动机；建筑的机械控制、照明和布线；雷达和导航系统；通信系统；电力公司使用的发电、电力控制和输电设备。电气工程师还设计汽车和航空器的电气系统。

Electronics engineers are responsible for a wide range of technologies, from portable music players to global positioning systems (GPS), which can continuously provide the location of, for example, a vehicle. Electronics engineers design, develop, test, and supervise the manufacture of electronic equipment such as broadcast and communications systems. Many electronics engineers also work in areas closely related to computers. However, engineers whose work is related exclusively to computer hardware are considered computer hardware engineers. Electronics engineers specialize in areas such as communications, signal processing, and control systems or have a specialty within one of these areas—control systems or aviation electronics, for example.

电子工程师负责各种各样的技术，从便携式音乐播放器到全球定位系统（GPS）。GPS 可以持续提供车辆等的位置信息。电子工程师从事电子设备的设计、开发和测试，并监管电子设备的制造，如广播和通信系统。许多电子工程师的工作领域还与计算机密切相关。但是，若工程师所从事工作仅与计算机硬件相关，则被认为是计算机硬件工程师。电子工程师专攻通信、信号处理和控制系统等领域，或者专门研究这些领域中的某一方面，如控制系统或航空电子。

3. Mechanical engineering is one of the largest, broadest, and oldest engineering disciplines. Mechanical engineers use the principles of energy, materials, and mechanics to design and manufacture machines and devices of all types. They create the processes and systems that drive technology and industry.

机械工程学是规模最大、领域最广、历史最为悠久的工程学科之一。机械工程师运用能源、材料和力学原理设计生产各种类型的机器和装置。他们所创立的工艺流程和体系驱动了技术与工业的发展。

Mechanics, energy and heat, mathematics, engineering sciences, design and manufacturing form the foundation of mechanical engineering. Mechanics includes fluids, ranging from still

water to hypersonic gases flowing around a space vehicle; it involves the motion of anything from a particle to a machine or complex structure.

力学、能量与热量、数学、工程学及设计与制造构成了机械工程学的基础。力学的范围涵盖各种流体，从静止的水至环绕航天器的高速气体。力学涉及任何物体的运动，小至粒子，大至机器或复杂的结构。

Engineers in this discipline work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also work on power-using machines such as refrigeration and air-conditioning equipment, machine tools, material-handling systems, elevators and escalators, industrial production equipment, and robots used in manufacturing. Some mechanical engineers design tools that other engineers need for their work. In addition, mechanical engineers work in manufacturing or agriculture production, maintenance, or technical sales; many become administrators or managers.

该学科的工程师从事生产供应动力的机器，如发电机、内燃机、蒸汽涡轮机；他们也从事生产耗能机器，如冰箱、空调设备、机床、材料加工系统、电梯和自动扶梯、工业生产设备及用于生产的机器人。有的机械工程师设计其他工程师工作中所需要的工具。此外，机械工程师也从事大规模生产或农业生产、维护或技术销售。也有很多人成为经理或管理者。

4. Computer software engineers can generally be divided into two categories: applications engineers and systems engineers. Computer applications software engineers analyze end users' needs and design, construct, deploy, and maintain general computer applications software or specialized utility programs. These workers use different programming languages, depending on the purpose of the program and the environment in which the program runs. The programming languages most often used are C, C++, Java, and Python. Some software engineers develop packaged computer applications, but most create or adapt customized applications for business and other organizations. Some of these workers also develop databases.

计算机软件工程师一般可以分为两大类：应用工程师和系统工程师。计算机应用软件工程师分析终端用户的需求，设计、构建、部署和维护通用计算机应用软件或专门的实用程序。这些工程师根据程序的目的和运行环境使用不同的编程语言。最常用的编程语言是 C，C++，Java 和 Python。某些软件工程师开发打包的计算机应用软件，但大多数创建或修改本公司与其他公司定制的应用程序。有些软件工程师还开发数据库（应用软件）。

Computer systems software engineers coordinate the construction, maintenance, and expansion of an organization's computer systems. Working with the organization, they coordinate each department's computer needs—ordering, inventory, billing, and payroll recordkeeping, for example—and make suggestions about its technical direction. They also might set up the organization's intranets—networks that link computers within the organization and ease communication among various departments. Often, they are also responsible for the design and implementation of system security and data assurance.

计算机系统软件工程师负责协调机构计算机系统的建设、维护和扩展。他们协调各部门的计算机需求，例如，订货、库存、结算和工资记录留存，并提出技术方面的建议。他们架

构单位的内部网，即连接单位内部的计算机网络，方便各部门之间的信息互通。通常情况下，他们还负责设计和实施系统的安全性和数据保障体系。

Systems software engineers also work for companies that configure, implement, and install the computer systems of other organizations. These workers may be members of the marketing or sales staff, serving as the primary technical resource for sales workers, or providing logistical and technical support. Since the selling of complex computer systems often requires substantial customization to meet the needs of the purchaser, software engineers help to identify and explain needed changes. In addition, systems software engineers are responsible for ensuring security across the systems they are configuring.

系统软件工程师配置、实施或者安装计算机系统。这些工程师可能是营销团队成员或销售人员，或作为销售人员的主要技术资源，或提供后勤和技术支持。由于复杂的计算机系统通常需要大量的定制，软件工程师要帮助确定和解释所需的变更。此外，系统软件工程师还负责确保他们所配置的系统的安全性。

Task 1 *Match the words with their definitions.*

discipline _____ maintain_____ extremely_____ apparatus_____ innate_____
circuit_____ generator_____ etymology_____ overlap_____ permutation_____

①a representation of common ground between theories or phenomena
②engine that converts mechanical energy into electrical energy by electromagnetic induction
③equipment designed to serve a specific function
④keep in a certain state
⑤a history of a word
⑥not established by conditioning or learning
⑦an electrical device that provides a path for electrical current to flow
⑧to a high degree or extent
⑨an event in which one thing is substituted for another
⑩a branch of knowledge

Task 2 *Complete the following sentences with the phrases given below and translate them into Chinese.*

specialize in a range of be consistent with date back to derive from

① He says future reforms must _____ free trade and open investment.

_____

② Start-up costs are lower, because each business can _____ just one narrow segment.

_____

③ These abilities _____ something called machine learning, which is at the heart of many modern AI applications.