高等教育规划教材

机械工程专业英语

廖宇兰 主编

化学工业出版社

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·北京·

本书共16个单元，内容包括机械工程基础（工程材料及其处理、绘图、公差、机械原理、机械零件、热加工和成型技术等），机械加工设备与技术，计算机化制造技术和机电一体化技术（涉及数控技术、工业机器人、计算机辅助设计与制造、柔性制造和成组技术等），装配，农业机械（涉及常用的动力机械如汽油机和柴油机，常用的农业机械如拖拉机）。

本书内容的选取均为国内外报刊、杂志、教材、论著和其他文选，内容编排按照学生学习专业知识的过程循序渐进，有连贯性，英语语言由浅入深，有系统性。每个单元围绕一个主题（theme）编选课文和练习题。

本书可作为高等工科院校学生教学用书，并可供机械、机械电子、车辆等行业的科研、工程技术人员参考。

本书有配套电子教案，可赠送给用本书作为授课教材的院校和老师，如有需要，可发邮件至hqlbook@126.com索取。

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前　言

本教材是根据《大学英语教学大纲（修订本）》对专业英语学习阶段的要求，结合各校目前的实际情况和教学计划安排，农业机械化及其自动化、机械设计制造及其自动化和机械电子工程等专业而编写的。目的是在教师的指导下，通过一定的阅读量，重点培养学生阅读本专业书刊的能力。

叙述科技内容的语言和日常生活用语固然是同一种语言，但科技英语在其词汇和语言风格上毕竟有其特点。科学技术本身的多学科性要求专业英语与专业内容相互一致。因此，专业英语（English for Special Science and Technology）和科技英语（EST）在语言特点上虽然是一致的，但是在专业内容上（主要表现在词汇方面）其覆盖面又有其特点，同一个单词在不同的专业中往往有不同的含义。作为专业英语重点关心本专业的相关内容，目的是以英语为工具获得本专业的信息。

本教材共分五部分，共 16 个单元。第一部分为机械工程基础，包括工程材料及其处理、绘图、公差、机械原理、机械零件、热加工和成型技术等。第二部分为机械加工设备与技术。第三部分为计算机化制造技术和机电一体化技术，涉及数控技术、工业机器人、计算机辅助设计与制造、柔性制造和成组技术等。第四部分为装配方面的内容。第五部分为部分农业机械方面的内容，涉及常用的动力机械如汽油机和柴油机，常用的农业机械如拖拉机。

本教材内容的选取均为国内外报刊、杂志、教材、论著和其他文选，内容编排按照学生学习专业知识的过程循序渐进，有连贯性，英语语言由浅入深，有系统性。每个单元围绕一个主题（theme）编选课文和练习题。因课堂学习学时有限，可有针对性地选择每单元的前面章节作为重点学习内容，其余部分可作为课后阅读材料，以获得较完整的专业英语知识。

本书由廖宇兰主编。撰写分工为：第一部分，第 1、6、7 单元（廖宇兰），第 2、3 单元（罗洪峰），第 4 单元（朱冬云），第 5 单元（李粤）；第二部分，第 8 单元（郭志忠），第 9 单元（李粤、朱冬云），第 10、11 单元（廖宇兰）；第三部分，第 12、13 单元（张燕），第 14 单元（廖宇兰）；第四部分，第 15 单元（翁绍捷）；第五部分，第 16 单元（袁成宇）；词汇（罗洪峰）。全书由廖宇兰统稿，廖宇兰和张燕校订。

对于书中存在的不足之处，望同行专家及广大读者给予批评指正。

廖宇兰

2009 年 4 月

Preface

According to "national syllabus of college English (revised edition)" for the requirement of SBE learning stage, considering the actual condition and teaching planned arrangement of our university, this teaching material is compiled for specialties such as mechanization of farming and its automatization、mechanical design & manufacture and its automatization and so on. With this book, under the guidance of teacher and through certain reading, the student will get the ability of reading his professional materials.

Although the language used to statement science and technology are same language as used in daily life, scientific and technical English has its own characteristic on its vocabulary and language style. Because of the multi-disciplinary demands of science and technology, SBE should be consistent with the substance of the corresponding subject. So, Although the English of science and technology (EST) is thoughly consistent with SBE on language characteristic, its coverage has its own characteristic on professional content (major expression in vocabulary aspect). A same word often has different meaning in different special field. The emphasis of SBE is the relevant portion of specialized content, the main purpose of SBE is to get the useful information of own special field by means of English.

This teaching material has 5 parts totally, contains 16 Units. The first part is fundamentals of mechanical engineering, includes materials and its treatment and properties, mechanical drawing, engineering tolerancing, mechanism, machine parts, hot working and forming processes and so on. The second part is equipment and technology of machine manufacture. The third part is computerized manufacturing and mechantronics technologies, includes technology of numerical control, industrial robot, CAD/CAM, flexible manufacturing, group technology and so on. The fourth part is the content in the aspect of assembly. The fifth part is machinery for agriculture, concerned with the patrol engine, diesel engine, tractor and so on.

This teaching material is selected from the publications of domestic and abord publishers. Its content has continuity and step by step according to the learning process of undergraduate in professional knowledge; English language goes from easy to difficult and complicated systematically. Every unit compiles text and practice problem revolving around a theme. In order to get full professional English knowledge, student should select the preceding chapter per unit as focal point to study because of limited class hours and others reading materials should be self-studied.

Liao Yulan is chief editor in this book. The division of labor is: The first part: The 1st, 6-7th units (Liao Yulan), the 2-3rd unit (Luo Hongfeng), the 4th unit (Zhu Dongyun), the 5th unit (Li Yue). The second part: The 8th unit (Guo Zhizhong), the 9th unit (Li Yue, Zhu

Dongyun), the 10-11th unit (Liao Yulan). The third part: The 12-13th unit (Zhang Yan), the 14th unit (Liao Yulan). The fourth part: The 15th unit (Weng Shaojie). The fifth part: The 16th unit (Yuan Chengyu). Glossary (Luo Hongfeng). This book is compiled by Liao Yulan and checked by Liao Yulan and Zhang Yan.

Since hurry to compile this book, shortcomings and mistakes are hard to avoid, it is open to criticism and proposal.

Liao Yulan
April 2009

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Part1 Fundamentals of Mechanical Engineering

Unit1 Mechanical Engineering

Passage I Introduction to Mechanical Engineering

Mechanical engineering is the branch of engineering that deals with machines and the production of power. It is particularly concerned with forces and motion.

History of Mechanical Engineering

The invention of the steam engine in the latter part of the 18th century, providing a key source of power for the Industrial Revolution, gave an enormous impetus to the development of machinery of all types. As a result a new major classification of engineering, separate from civil engineering and dealing with tools and machines, developed, receiving formal recognition in 1847 in the founding of the Institution of Mechanical Engineers in Birmingham, England.

Mechanical engineering has evolved from the practice by the mechanic of an art based largely on trial and error to the application by the professional engineer of the scientific method in research, design, and production.

The demand for increased efficiency, in the widest sense, is continually raising the quality of work expected from a mechanical engineer and requiring of him a higher degree of education and training. Not only must machines run more economically but capital costs also must be minimized.

Fields of Mechanical Engineering

Development of machines for the production of goods The high material standard of living in the developed countries owes much to the machinery made possible by mechanical engineering. The mechanical engineer continually invents machines to produce goods and develops machine tools of increasing accuracy and complexity to build the machines.

The principal lines of development of machinery have been an increase in the speed of operation to obtain high rates of production, improvement in accuracy to obtain quality and economy in the product, and minimization of operating costs. These three requirements have led to the evolution of complex control systems.

The most successful production machinery is that in which the mechanical design of the machine is closely integrated with the control system, whether the latter is mechanical or electrical in nature. A modern transfer line (conveyor) for the manufacture of automobile engines is a good example of the mechanization of a complex series of manufacturing processes. Developments are in hand to automate production machinery further, using computers to store and process the vast amount of data required for manufacturing a variety of components with a small number of versatile machine tools. One aim is a completely automated machine shop for batch production, operating on a three-shift basis but attended by a staff for only one shift per day.

Development of machines for the production of power Production machinery presupposes an ample supply of power. The steam engine provided the first practical means of generating power from heat to augment the old sources of power from muscle, wind, and water. One of first challenges to the new profession of mechanical engineering was to increase thermal efficiencies and power; this was done principally by the development of the steam turbine and associated large steam boilers. The 20th century has witnessed a continued rapid growth in the power output of turbines for driving electric generators, together with a steady increase in thermal efficiency and reduction in capital cost per kilowatt of large power stations. Finally, mechanical engineers acquired the resource of nuclear energy, whose application has demanded an exceptional standard of reliability and safety involving the solution of entirely new problems. The control systems of large power plants and complete nuclear power stations have become highly sophisticated networks of electronic, fluidic, electric, hydraulic, and mechanical components, all of these involving the province of the mechanical engineer.

The mechanical engineer is also responsible for the much smaller internal combustion engines, both reciprocating (gasoline and diesel) and rotary (gas-turbine and Wankel) engines, with their widespread transport applications. In the transportation field generally, in air and space as well as on land and sea, the mechanical engineer has created the equipment and the power plant, collaborating increasingly with the electrical engineer, especially in the development of suitable control systems.

Development of military weapons The skills applied to war by the mechanical engineer are similar to those required in civilian applications, though the purpose is to enhance destructive power rather than to raise creative efficiency. The demands of war have channelled huge resources into technical fields, however, and led to developments that have profound benefits in peace. Jet aircraft and nuclear reactors are notable examples.

Bioengineering Bioengineering is a relatively new and distinct field of mechanical engineering that includes the provision of machines to replace or augment the functions of the human body and of equipment for use in medical treatment. Artificial limbs have been developed incorporating such lifelike functions as powered motion and touch feedback. Development is rapid in the direction of artificial spare-part surgery. Sophisticated heart-lung machines and similar equipment permit operations of increasing complexity and permit the vital functions in seriously injured or diseased patients to be maintained.

Environmental control Some of the earliest efforts of mechanical engineers were aimed at controlling man's environment by pumping water to drain or irrigate land and by ventilating mines. The ubiquitous refrigerating and air-conditioning plats of the modern age are based on a reversed heat engine, where the supply of power 'pumps' heat from the cold region to the warmer exterior.

Many of the products of mechanical engineering, together with technological developments in other fields, have side effects on the environment and give rise to noise, the pollution of water and air, and the dereliction of land and scenery. The rate of production, both of goods and power, is rising so rapidly that regeneration by natural forces can no longer keep pace. A rapidly growing field for mechanical engineers and others is environmental control, comprising the development of machines and processes that will produce fewer pollutants and of new equipment and techniques that can reduce or remove the pollution already generated.

Functions of Mechanical Engineering

Four functions of the mechanical engineering, common to all the fields mentioned, be cited. The first is the understanding of and dealing with the bases of mechanical science. These include dynamics, concerning the relation between forces and motion, such as in vibration; automatic control; thermodynamics, dealing with the relations among the various forms of heat, energy, and power; fluid flow; heat transfer; lubrication; and properties of materials.

Second is the sequence of research, design, and development. This function attempts to bring about the changes necessary to meet present and future needs. Such work requires not only a clear understanding of mechanical science and an ability to analyze a complex system into its basic factors, but also the originality to synthesize and invent.

Third is production of products and power, which embraces planning, operation, and maintenance. The goal is to produce the maximum value with the minimum investment and cost while maintaining or enhancing longer term viability and reputation of the enterprise or the institution.

Fourth is the coordinating function of the mechanical engineering, including management, consulting, and, in some cases, marketing.

In all of these functions there is a long continuing trend toward the use of scientific instead of traditional or intuitive methods, an aspect of the ever-growing professionalism of mechanical engineering. Operations research, value engineering, and PABLA (problem analysis by logical approach) are typical titles of such new rationalized approaches. Creativity, however, cannot be rationalized. The ability to take the important and unexpected step that opens up new solutions remains in mechanical engineering, as elsewhere, largely a personal and spontaneous characteristic.

The Future of Mechanical Engineering

The number of mechanical engineers continues to grow as rapidly as ever, while the duration and quality of their training increases. There is a growing awareness, however, among engineers and in the community at large that the exponential increase in population and living standards is raising formidable problems in pollution of the environment and the exhaustion of natural resources; this clearly heightens the need for all of the technical professions to consider the long-term social effects of discoveries and developments. There will be an increasing demand for mechanical engineering skills to provide for man's needs while reducing to a minimum the consumption of scarce raw materials and maintaining a satisfactory environment.

Words and Expressions

mechanical engineering 机械工程（学）

key /kiː/*n.*	键，楔
adj.	主要的，关键的
impetus /ˈimpitəs/*n.*	推动力，动力
trial and error	试错法
capital cost	基建费，投资费
conveyor /kənˈveiə/*n.*	输送机；运输装置，传送器
three-shift /ˈθriːʃift/*n.*	三班制
augment /ɔːgˈment/*vt.* & *vi.*	增大，增加
thermal /ˈθəːməl/*n.*	热
adj.	热的，热量的
reduction /riˈdʌkʃən/*n.*	还原
power plant	发电厂，动力装置
reciprocating /riˈsiprəkeitiŋ/*adj.*	往复的
collaborate /kəˈlæbəreit/*vi.*	合作，协作
bioengineering /ˌbaiəuˌendʒiˈniəriŋ/*n.*	生物工程学
pollutant /pəˈljuːtənt/*n.*	污染物，污染物质
dynamics /daiˈnæmiks/*n.*	力学，动力学
thermodynamics /ˈθəːməudaiˈnæmiks/*n.*	热力学
operations research	运筹学
value engineering	价值工程，工程经济学
PABLA	逻辑法问题分析
exponential /ˌekspəuˈnenʃəl/*n.*	指数
adj.	指数的，幂数的
formidable /ˈfɔːmidəbl/*adj.*	强大的；可怕的；艰难的

Exercises

Ⅰ. Choose the best answer according to the information of the text.

1. Mechanical engineering is especially concerned with ____________.
   a. stress and strains b. forces and motion
   c. electric power d. production of machines
2. ________ provided a key source of power for the Industrial Revolution.
   a. Steam engine b. The discovery of electricity
   c. Turbine d. Motors
3. In 1847 the founding of the ________ marked the formal recognition of mechanical engineering.
   a. steam engine society
   b. Institution of Mechanical Engineers in Birmingham
   c. Institution of Mechanical Engineers in London
   d. Mechanical Engineering society
4. The fields of mechanical engineering include the following except ________.
   a. the development of machines b. the development of military weapons
   c. the development of computers d. environmental control

5. Which of the following is NOT the requirements that have led to the evolution of complex control systems?

a. the speed of operation b. high rates of production

c. minimization of operation cost d. the demand for higher degree of education

6. Which of the following is NOT included in the study of mechanical engineering functions?

a. dynamics b. automatic control c. computers d. lubrication

7. The word 'process' in Para. 7, Line 6 means ________ .

a. series of action b. changes

c. deal with officially d. perform operations in a computer

8. Mechanical engineers collaborate more and more with ________ especially in the development of suitable control systems.

a. electrical engineers b. computer designers

c. experienced technicians d. skilled workers

9. The demands of war have stimulated developments in mechanical field which have great benefit in peace. ________ is an example.

a. Chemical weapons b. Nuclear reactors

c. Ballistic missiles d. Cannons

10. There is a growing awareness among modern mechanical engineers about ________ .

a. exhaustion of natural resources b. development of military weapons

c. pollution of the environment d. both a and c

Ⅱ. Fill in the blanks according to the information of the text.

1. Mechanical engineering deals with ________ and ________ .

2. The mechanical design of a successful production machinery is closely integrated with ________ .

3. The demand for ________ stimulates mechanical engineers to raise the quality of work.

4. The production of products and power includes planning ________ and ________ .

5. During the process of development mechanical engineering has undergone ________ .

6. Coordinating functions of mechanical engineers include ________, ________, even ________ .

7. The second function of mechanical engineering is about the sequence of ________, ________, and ________ .

8. The development in, mechanical engineering as well as developments in other technological fields has brought about environment problem such as ________, pollution of water, ________ of land and scenery.

9. The high material standard of living in the developed countries owes much to ________ .

10. Production machinery presupposes ________ .

Ⅲ. Translate the following passage into Chinese.

Manufacturing engineers select and coordinate specific processes and equipment to be used, or supervise and manage their use. Some design special tooling that is used so that standard machines can be utilized in producing specific products. These engineers must have a broad knowledge of machine and process capabilities and of materials, so that desired operations can be done effectively and efficiently without overloading or damaging machines and without adversely affecting the materials being processed.

Passage Ⅱ Introduction to Design

The Meaning of Design

To design is to formulate a plan for the satisfaction of a human need. The particular need to be satisfied may be quite well defined from the beginning. Here are two examples in which needs are well defined:

1. How can we obtain large quantities of power cleanly, safely, and economically without using fossil fuels and without damaging the surface of the earth?

2. This gearshaft is giving trouble; there have been eight failures in the last six weeks. Do something about it.

On the other hand, the statement of a particular need to be satisfied may be so nebulous and ill defined that a considerable amount of thought and effort is necessary in order to state it clearly as a problem requiring a solution. Here are two examples:

1. Lots of people are killed in airplane accidents.

2. In big cities there are too many automobiles on the streets and highways.

This second type of design situation is characterized by the fact that neither the need nor the problem to be solved has been identified. Note, too, that the situation may contain not one problem but many.

We can classify design, too. For instance, we speak of:

1. Clothing design
2. Interior design
3. Highway design
4. Landscape design
5. Building design
6. Ship design
7. Bridge design
8. Computer-aided design
9. Heating system design
10. Machine design
11. Engineering design
12. Process design

In fact, there are an endless number, since we can classify design according to the particular article or product or according to the professional field.

In contrast to scientific or mathematical problems, design problems have no unique answers; it is absurd, for example, to request the 'correct answer' to a design problem, because there is none. In fact, a 'good' answer today may well turn out to be a 'poor' answer tomorrow, if there is a growth of knowledge during the period or if there are other structural or societal changes.

Almost everyone is involved with design in one way or another, even in daily living, because problems are posed and situations arise which must be solved. A design problem is not a hypothetical problem at all. Design has an authentic purpose—the creation of an end result by taking definite action, or the creation of something having physical reality. In engineering, the word design conveys different meanings to different persons. Some think of a designer as one who employs the drawing board to draft the details of a gear, clutch, or other machine member. Others think of design as the creation of a complex system, such as a communications network. In some areas of engineering the word design has been replaced by other terms such as systems engineering or applied decision theory. But no matter what words are used to describe the design function, in engineering it is still the process in which scientific principles and the tools of engineering—mathematics, computers, graphics, and English—are used to produce a plan which, when carried out, will satisfy a human need.

Mechanical Engineering Design

Mechanical design means the design of things and systems of a mechanical nature machines, products, structures, devices, and instruments. For the most part, mechanical design utilizes mathematics, the materials sciences, and the engineering mechanics sciences.

Mechanical engineering design includes all mechanical design, but it is a broader study, because it includes all the disciplines of mechanical engineering, such as the thermal and fluids sciences, too. Aside from the fundamental sciences that are required, the first studies in mechanical engineering design are in mechanical design.

The Phases of Design

The complete process, from start to finish, is often outlined as in Fig. 1-1. The process begins with a recognition of a need and a decision to do something about it. After many iterations, the process ends with the presentation of the plans for satisfying the need.

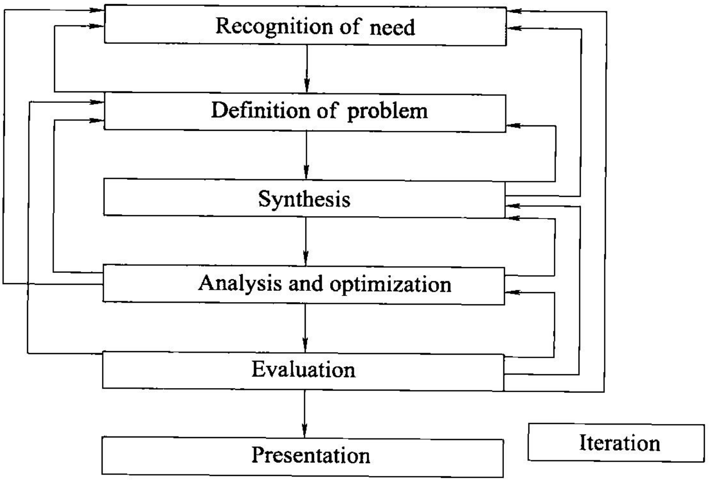

Fig. 1-1 The phases of design

Design Considerations

Sometimes the strength required of an element in a system is an important factor in the determination of the geometry and the dimensions of the element. In such a situation we say that strength is an important design consideration. When we use the expression design consideration, we are referring to some characteristic which influences the design of the element or, perhaps, the entire system. Usually quite a number of such characteristics must be considered in a given design situation. Many of the important ones are as follows:

1. Strength
2. Reliability
3. Thermal properties
4. Corrosion
5. Wear
6. Friction

7. Processing
8. Utility
9. Cost
10. Safety
11. Weight
12. Life
13. Noise
14. Styling
15. Shape
16. Size
17. Flexibility
18. Control
19. Stiffness
20. Surface finish
21. Lubrication
22. Maintenance
23. Volume
24. Liability

Some of these have to do directly with the dimensions, the material, the processing, and the joining of the elements of the system. Other considerations affect the configuration of the total system.

To keep the correct perspective, however, it should be observed that in many design situations the important design considerations are such that no calculations or experiments are necessary in order to define an element or system. Students, especially, are often confounded when they run into situations in which it is virtually impossible to make a single calculation and yet an important design decision must be made. These are not extraordinary occurrences at all; they happen every day. Suppose that it is desirable from a sales standpoint—for example, in medical laboratory machinery—to create an impression of great strength and durability. Thicker parts assembled with larger-than-usual oversize bolts can be used to create a rugged-looking machine. Sometimes machines and their parts are designed purely from the standpoint of styling and nothing else. These points are made here so that you will not be misled into believing that there is a rational mathematical approach to every design decision.

Words and Expressions

gearshaft /'giəʃɑ:ft/*n.* 齿轮轴
nebulous /'nebjuləs/*adj.* 模糊的，朦胧的
computer-aided design 计算机辅助设计
hypothetical /ˌhaipəu'θətikəl/*adj.* 假设的，假定的
authentic /ɔ:'θentik/*adj.* 真实的，确凿的
clutch /klʌtʃ/*n.* 离合器，联轴器
member /'membə/*n.* 组成部分，构件
graphics /'græfiks/*n.* 图解计算法，图形法
liability /ˌlaiə'biliti/*n.* 易用性，倾向性，责任
configuration /'kənˌfigju'reiʃən/*n.* 构造，结构；配置；

Passage Ⅲ Manufacturing

Manufacturing is that enterprise concerned with converting raw material into finished products. There are three distinct phases in manufacturing. These phases are as follows: input, processing, and output.

The first phase includes all of the elements necessary to create a marketable product. First, there must be a demand or need for the product. The necessary materials must be available. Also needed are such resources as energy, time, human knowledge, and human skills. Finally, it takes capital to obtain all of the other resources.