ВВЕДЕНИЕ

В пособие включены неадаптированные тексты из английской и американской литературы, касающиеся проблем, актуальных для технических наук. В частности, эти тексты содержат лексику и грамматические трудности, встречающиеся в любых современных английских и американских научно-технических работах, в особенности по техническим дисциплинам. Предлагаемый материал позволит усвоить общенаучные слова и фразеологические сочетания, закрепить знания по всему курсу грамматики и перейти к свободному чтению современной технической литературы намного быстрее.

Тексты объединены в разделы и снабжены специальными заданиями как для проверки общего содержания, так и для закрепления лексики. Тексты также содержат клише, которые используются в профессиональной инженерной лексике. Наиболее употребительные слова и сочетания слов по каждому разделу даются в вводном тексте. Основной тематический словарь представлен здесь в типичных для него лексических и грамматических связях. Самостоятельную работу над пособием следует начинать с детального ознакомления с вводными текстами по соответствующим разделам. Тематические словари каждого раздела включают лексические единицы, представленные в соответствующих вводных текстах. Здесь даны отдельные слова, словосочетания и их русские эквиваленты, синонимы, антонимы. Цель задания — самостоятельно отработать и усвоить наиболее важные лексические

явления. Упражнения составлены так, чтобы по возможности удовлетворить потребности обучающихся с различной языковой подготовкой.

Во многих упражнениях использованы выдержки из оригинальных произведений, методических разработок английских, американских и других авторов, а также периодики, издающихся на английском языке. В частности стоит упомянуть следующие книги: Sopranzi. S. Flash on English for Mechanics, Electronics and Technical Assistance [15], Evans, V., Write, S. Information Technology [12].

В ключах к заданиям даны ответы только для тех упражнений, которые предполагают единообразный подход и результат.

1. GENERAL INFORMATION ON ENGINEERING

TEXT 1.1. THE IMPACT OF RESEARCH AND DEVELOPMENT ON ENGINEERING AND SCIENCE

Those of us who live in the modern world of science and technology of the XXI century are apt to think that the concept or concepts of research and development belong peculiarly to modern generation, starting within their lifetime and being the dominant characteristics of their time; that our science and engineering are the first to feel the impact. However, science has used experimental and theoretical investigation or research as its principal tool since the dawn of modern science beginning with Galileo. And engineering has used development as one of its principal tools for centuries. The process of development goes right back to the first device or tool used by man, a club, a lever or a bow.

The fields of science and engineering began to link intimately in the XIX century. Prior to then, most inventions and engineering developments stemmed from the practical needs of life and were produced by craftsmen and artisans. Science, on the other hand, or natural philosophy, as it was called until the XIX century, was mostly quite remote from the practicalities of life. However, in the nineteenth century scientific research, which was undertaken purely in the search for knowledge and understanding, began occasionally to precede engineering application, even suggest-

ing new practical applications. In some cases, scientific inquiry opened previously unimagined areas of application, and in turn the resulting practical tools gave scientists more power to do new research.

We have lived for at least a century and a half with the intimate interdependence of engineering and science. The two methods of pursuing these fields, development and research, are by now old hat.

We even find that the engineer has borrowed the process of research from the scientist, and the scientist has borrowed the process of development from the engineer.

However, there is a characteristic of research and development which is peculiar to our time. This simply is that the research and development activity of scientists and engineers has now grown to such proportions that it is a major concern of all citizens. It is something big enough to be governed. In fact, it is now one of the principal causes of the growth of any government. The need to regulate research and development and its products is apparent in all sides.

One of the most characteristic features of research and development is the inexorable growth of technical project. It starts as simple, inexpensive activity involving only a few scientists or engineers, with the motive either of studying the nature of the universe or of developing something practical. Soon it reaches a stage when the idea begins to take on more advocates, i.e. either more scientists who realize that the idea is the beginning of a fruitful field for scientific investigation, or more engineers, industrialists and military men who realize that the idea, if properly developed, will pay off in their field of application. Then it proves itself successful and takes a place in the affairs of men in general. In the early days of the growth of the idea, its advancement is limited only by technical considerations.

As time goes on, however, the impact of this idea on society begins to bring other complicating factors, and it changes from performance limited stage to society limited case.

By using the power of research and development as conducted by scientists and engineers, many new ideas will grow to a point of size and importance where society itself, rather than a few enthusiastic engineers or scientists, will have to make the judgement of how much more should be done in this field. This need for collective action in the making of this judgement is really what is most characteristic of science and engineering in our generation.

Task 1.1.1. Choose the correct adjective.

1. sphere	A. spherous B. spherical C. spherocous
2. cube	A. cubed B. cubous C. cubal
3. cone	A. conacular B. conous C. conical
4. rectangle	A. rectanalous B. rectanglis C. rectangular
5. triangle	A. trianaular B. trianalous C. triangled
6. circle	A. circled B. circulous C. circular
7. square	A. square B. squaret C. squarous
8. cylinder	A. cvlindrous B. cylindal C. cylindrical

TEXT 1.2. SCIENTISTS STUDY THE WORLD AS IT IS, ENGINEERS CREATE THE WORLD THAT HAS NEVER BEEN

There exists an overlap between the sciences and engineering practice; in engineering, one applies science. Both areas of endeavor rely on accurate observation of materials and phenomena. Both use mathematics and classification criteria to analyze and communicate observations.

Scientists may also have to complete engineering tasks, such as designing experimental apparatus or building prototypes. Conversely, in the process of developing technology engineers sometimes find themselves exploring new phenomena, thus becoming, for the moment, scientists or more precisely “engineering scientists”.

In the book “What Engineers Know and How They Know It” Walter Vincenti asserts that engineering research has a character different from that of scientific research. First, it often deals with areas in which the basic physics or chemistry are well understood, but the problems themselves are too complex to solve in an exact manner.

There is a “real and important” difference between engineering and physics as similar to any science field has to do with technology. Physics is an exploratory science that seeks knowledge of principles while Engineering uses knowledge for practical applications of principles. The former equates an understanding into a mathematical principle while the latter measures variables involved and creates technology. For technology, physics is an auxiliary and in a way technology is considered as applied physics. Though Physics and Engineering are interrelated, it doesn't mean a Physicist is sufficient where an Engineer is required. For this mobility, a physicist to work as an engineer requires additional and relevant specialized training. Physicists and engineers engage in different lines of work. But PhD physicists who specialize in sectors of technology and applied science are titled as Technology officer, R&D Engineers and System Engineers. Though as an engineer, role of a physicist is limited. Physicists in their field work in theoretical analysis and experimental research.

An example of this is the use of numerical approximations to the Navier — Stokes equations to describe aerodynamic flow over an aircraft, or the use of Miner's rule to

calculate fatigue damage. Second, engineering research employs many semi-empirical methods that are foreign to pure scientific research, one example being the method of parameter variation.

As stated by Fung et al. in the revision to the classic engineering text Foundations of Solid Mechanics, Engineering is quite different from science. Scientists try to understand nature. Engineers try to make things that do not exist in nature. Engineers stress innovation and invention. To embody an invention the engineer must put his idea in concrete terms and design something that people can use. That "something" can be a complex system, a device, a gadget, a material, a method, a computing program, an innovative experiment, a new solution to a problem, or an improvement on what already exists. Since a design has to be realistic and functional, it must have its geometry, dimensions, and characteristics data defined. In the past engineers working on new designs found that they did not have all the required information to make design decisions. Most often, they were limited by insufficient scientific knowledge. Thus they studied mathematics, physics, chemistry, biology and mechanics. Often they had to add to the sciences relevant to their profession. Thus engineering sciences were born.

Although engineering solutions make use of scientific principles, engineers must also take into account safety, efficiency, economy, reliability, and constructability or ease of fabrication as well as the environment, ethical and legal considerations such as patent infringement or liability in the case of failure of the solution.

Task 1.2.1. Read text 1.2 and retell it in a few words.

TEXT 1.3. ENGINEERING AS A CAREER

Engineering is the application of mathematics and scientific, economic, social, and practical knowledge in order to invent, innovate, design, build, maintain, research, and improve structures, machines, tools, systems, components, materials, processes, solutions, and organizations.

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 term "***Engineering***" is derived from the Latin ***ingenium***, meaning "cleverness" and "ingeniare", meaning "to contrive, devise".

Engineering is one of today's fastest growing careers. That is because ***engineers*** work in so many areas. Some engineers ***design*** highways and railways. Others ***inspect*** very complicated machines. We can distinguish different types of engineering: civil and industrial engineering, mechanical engineering, computer and software engineering, materials, nuclear, aerospace, electrical, chemical, environmental, biomedical engineering, genetic, agricultural, even sales engineering. But no matter where engineers work, they all have two things in common: maths and science. ***Disciplines*** like ***mathematics*** and ***physics*** are a must for any engineer. And so becoming an engineer requires extensive study and deep knowledge.

Engineers ***develop*** fascinating new ideas. These new ideas change the world in big ways. Engineers also create the ***technologies*** that make our lives much easier. The field

of engineering truly is rather crucial in today's modern world. It is expanding every day and is a really great field to go into.

Task 1.3.1. Read and translate text 1.3, remember the following words and phrases from the text.

development — (*зд.*) проектно-конструкторские работы
challenge — вызов
civil engineering — гражданское строительство
club — дубинка
lever — лом, рычаг
bow — лук
craftsman — ремесленник
artisan — мастер, ремесленник
natural philosophy — естествознание
practicalities — практические запросы
inquiry — поиск, исследование
unimagined — непредвиденный
pursue — проводить работы
to be old hat — быть известным
inexorable — неизбежный, неуклонный
to pay off — давать результат
performance limited stage — стадия, определяемая достигнутыми техническими характеристиками
society limited case — проблема, определяемая социальными условиями

TEXT 1.4. HISTORY OF ENGINEERING

Engineering has existed since ancient times as humans devised fundamental inventions such as the wedge, lever,

wheel and pulley. Each of these inventions is essentially consistent with the modern definition of engineering.

The term “engineering” is derived from the word “engineer”, which itself dates back to 1390, when an engineer (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.

Task 1.4.1. Read text 1.4, then ask 15 questions to the text using all types of questions.

TEXT 1.5. ROLE OF THE ENGLISH LANGUAGE FOR ENGINEERING STUDENTS

Engineering is one of the biggest fields of study in the world, and many works of research and studies are recorded in English. English is very important for non-native English users because it is widely spoken all around the world. Persuasive English allows people to enjoy their life and work

no issue where they are. For engineering students whose mother tongue is not English, mastering English is even more important, not only for their scholastic life but also for their prospective career. The English language is the current lingua franca of international business, expertise and aviation. It is spoken by 1.8 billion people in the world and the number is still rising. Without a good command of the language, engineering students find themselves being unable to understand the underlying concept or idea that the authors try to convey in their papers. Moreover, many elements in engineering require writing academic reports such as lab reports, projecting reports, etc. Hence a good grasp of the English language is necessary. The English language has many features of capturing the corporate as well as the markets. It makes the candidate a certain, self-reliant, good communicator which is a need of present time. English is a medium which makes sure your present employability. You should understand the importance of English and how English can reduce the unemployability by learning communication skills. It also helps the people to attain a reverie job through communication skills.

Simply speaking, English for the topic "Engineering" covers the language which involves everything related to mathematics, physics and science. But it also involves much more.

Of course, the starting point is the language, so you must know grammar quite well, but vocabulary is very specific, too. English for engineers will challenge all your language skills, that is:

1) reading (documents and different technical texts);

2) writing (e-mails, technical reports and documents, filing data in grids, filling in forms);

3) listening (presentations, announcements, technical descriptions);

4) Speaking (in an interactive way with specialists in different fields of research and science).

These are all communication skills that you will use in certain situations. English for engineers will also help you understand many specialized subjects and topics that you will soon study and it will provide you with a set of technical terms in preparation for your future specific study of the language.

Task 1.5.1. Read text 1.5 and then retell it.

TEXT 1.6. TRAITS OF AN ENGINEER

What qualities must a perfect engineer have?

Obviously, we need an engineer with technical competency. Basic common sense is a must. Furthermore, having dependability means that people trust you. Most importantly, an outgoing person with excellent interpersonal skills is perfect. An engineer must be a person with courage to tell when things are going wrong.

A perfect engineer has good organizational skills and uses quantitative thinking to assess the work. He enjoys the challenge of problem solving, this means having the curiosity to ask questions. And more than anything else, a perfect engineer thinks about projects in the long-term and what they mean for the company.

Task 1.6.1. Talk about these problems.

1. What are good qualities for engineers to have?
2. How can these qualities be developed?

2. MATERIALS

TEXT 2.1. THE MAIN TYPES OF MATERIALS

An engineer uses different materials to build machinery or tools. A specific knowledge of materials is required, concerning qualities, properties, costs and general characteristics.

When a machine or a tool is made, the most suitable material must be chosen by considering its properties, which can be classified as mechanical, thermal, electrical and chemical. The main types of materials used in mechanical engineering are metals, polymer materials, ceramic and composite materials.

The most commonly used materials are metals, which can be divided into ferrous and non-ferrous. They can be used in their pure form or mixed with other elements. In this second case we have an alloy and it is used to improve some properties of the metals. The most commonly used ferrous metals are iron and alloys which use iron. Because iron is soft and pasty, it is not suitable to be used as a structural material, so a small amount of carbon is added to it to make steel alloy.

Non-ferrous metals contain little or no iron. The most common non-ferrous metals used in mechanical engineering are copper, zinc, tin and aluminium. Some common non-ferrous alloys are brass (formed by mixing copper and zinc), bronze (formed by mixing copper and tin) and other aluminium alloys which are used in the aircraft industry. Other examples of materials used in engineering are plastic and rubber.

PVC or polyvinyl chloride is a type of plastic and is used to insulate wires and cables. Rubber is a polymer and its best property is elasticity, as it returns to its original size and shape after deformation. Ceramic materials are good insulators: hard, resistant and strong but brittle. Composite materials are made up of two or more materials combined to improve their mechanical properties. Concrete is reinforced with steel and is used in building engineering.

Task 2.1.1. Read text 2.1 and match the words with their definitions.

1. alloy	a. a type of plastic used for insulation
2. steel	b. a combination of different materials
3. PVC	c. an alloy formed by mixing iron and carbone
4. concrete	d. an alloy formed by mixing copper and zinc
5. brass	e. metals containing iron
6. ferrous materials	f. a composite material used to build houses
7. ceramic	g. a metal not suitable as structural material
8. iron	h. a good insulator but brittle

Task 2.1.2. Read text 2.1 again and answer the questions.

1. What is the basic classification of metals?
2. What are the characteristics of iron?
3. Why are alloys created?
4. Which materials are good insulators?
5. Is steel an alloy? Which metal does it contain?

Task 2.1.3. Match the words with their definitions.

Word bank

cooking	coins	alloy
air	copper	wires
steel	carbon	gold
ferrum	expensive	ductile

I. Iron: its Latin name is 1._____. It is magnetic and has a silver colour. In prehistoric times it was used to make ornaments and weapons. If exposed to the 2._____, it oxidizes.

II. 1._____: it is one of the most widely used materials by humans. In prehistoric times it was used to make cooking utensils, 2._____ and ornamental objects. It is used in 3._____ and cables.

III. 1._____: it is the most 2._____ metal and is used to create precious jewellery. It is the most 3._____ metal.

IV. 1._____: it is an 2._____ formed from iron and 3._____. It can contain between 2.1% and 4% carbon. It is also used for 4._____ utensils and pans.

Task 2.1.4. Write a summary of the two texts about the materials following the plan below.

Plan of the Summary

1. Write about the importance in engineering of having a specific knowledge of materials.
2. List the materials and the main groups used in engineering.

3. Tell the difference between ferrous and non-ferrous metals.
4. Say what an alloy is and why it is used.
5. Write a list of non-ferrous metals and alloys.

Task 2.1.5. Shape and features: match the words below with the pictures.

1. pyramid; 2. cube; 3. crescent; 4. spiral; 5. cone; 6. sphere; 7. rectangle; 8. triangle; 9. square; 10. circle; 11. cylinder; 12. oval.

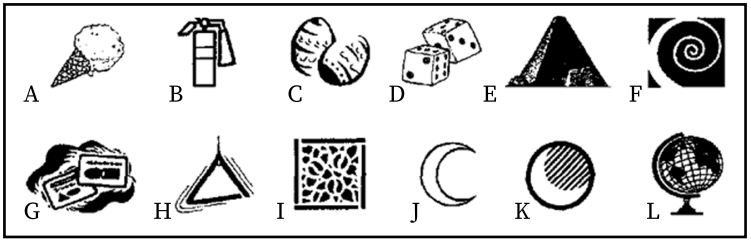

Fig. 1

Task 2.1.3. Study the glossary on the topic.

alloy — сплав
bar — слиток, стержень, брусок, штанга
bent — прогиб, изгиб
blacksmith — кузнец
brass — латунь
brick — кирпич
brittle — хрупкий
bronze — бронза
carbon — углерод
casting — литье, отливка
concrete — бетон

copper — медь
die — штамп, матрица, фильера
drawing — чертеж
ductile — ковкий, пластичный, ковкое железо
extrusion — прессование, выдавливание, экструзия (металла)
flat — плоский
hammer — молот, молоток
hollow — полый
to improve — улучшать
to insulate — изолировать
machinery — оборудование
mould — пресс-форма, форма для отливки
to oxidize — окисляться
pipe — труба, трубопровод
plastic — пластмасса
rod — штырь, штифт, стержень, шток, брус
rolling — прокат стальной
rubber — резина
shape — форма
sheet — лист
steel — сталь
tin — олово
tool — инструмент
tube — трубка
wire — провод
zinc — цинк

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