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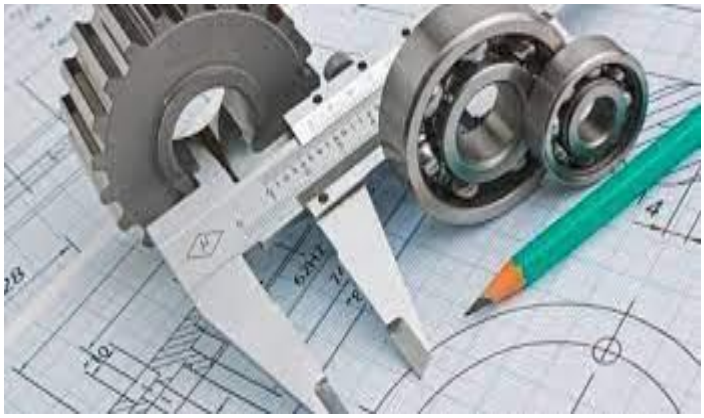
Луцького національного технічного університету»

АНГЛІЙСЬКА МОВА

за професійним спрямуванням

Методичні вказівки до практичних занять
для здобувачів освітньо-професійного ступеня
фаховий молодший бакалавр
спеціальності 133 Галузеве машинобудування
денної форми навчання



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А 64

Затверджено до видання методичною радою ВСП «КПЕФК ЛНТУ»,

протокол № від « » 2023 року.

Голова методичної ради ВСП «КПЕФК ЛНТУ»_____ Ігор ІЛЮШИК

Розглянуто і схвалено на засіданні циклової комісії гуманітарних та соціально-економічних дисциплін ВСП «Ковельський промислово-економічний фаховий коледж ЛНТУ»,

протокол № від « » 2023 року.

Голова циклової комісії _____ Ніна БАЙЧУК

Електронна копія друкованого видання передана до книжкового фонду бібліотеки ВСП «КПЕФК ЛНТУ»

Завідувачка бібліотеки_____ Неля ТЕЛЮЧИК
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А 64 Англійська мова за професійним спрямуванням [Текст]: методичні вказівки до практичних занять для здобувачів освітньо-професійного ступеня фаховий молодший бакалавр спеціальності 133 Галузеве машинобудування денної форми навчання/уклад. Оксана Грисюк. – Ковель: ВСП «КПЕФК ЛНТУ», 2023. – 63 с.

Методичні вказівки складаються з 20 професійно-орієнтованих тем. Кожна тема містить автентичні англомовні тексти з розробленим методичним забезпеченням.

Мета методичних вказівок – навчити здобувачів освіти активному володінню англійською мовою в сфері професійної діяльності інженера-механіка, а також формуванню у них здатності і готовності до комунікації.

Видання призначене для добувачів освітньо-професійного ступеня фахового молодшого бакалавра спеціальності 133 Галузеве машинобудування і сприятиме формуванню навичок, розвитку і вдосконаленню вмінь у читанні, аудіюванні, говорінні, письмі та перекладі; підвищенню ефективності організації навчання іноземної мови професійного спрямування в аудиторний та позааудиторний час.

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Contents

ПЕРЕДМОВА

Методичні вказівки «Англійська мова за професійним спрямуванням» спрямовані на формування професійної англомовної компетентності у студентів третього курсу спеціальності 133 Галузеве машинобудування промислово-економічного фахового коледжу.

Методичні вказівки складено згідно з вимогами навчальної програми з іноземної мови для підготовки фахових молодших бакалаврів з машинобудування та інженерії.

Мета посібника — розвиток навичок розуміння й аналізу оригінальних текстів із основних проблем машинобудування, нагромадження словникового запасу, удосконалення навичок розмовної мови, уміння вести бесіду, брати участь у дискусіях англійською мовою, формувати соціально-комунікативну позицію фахівця в галузі машинобудування.

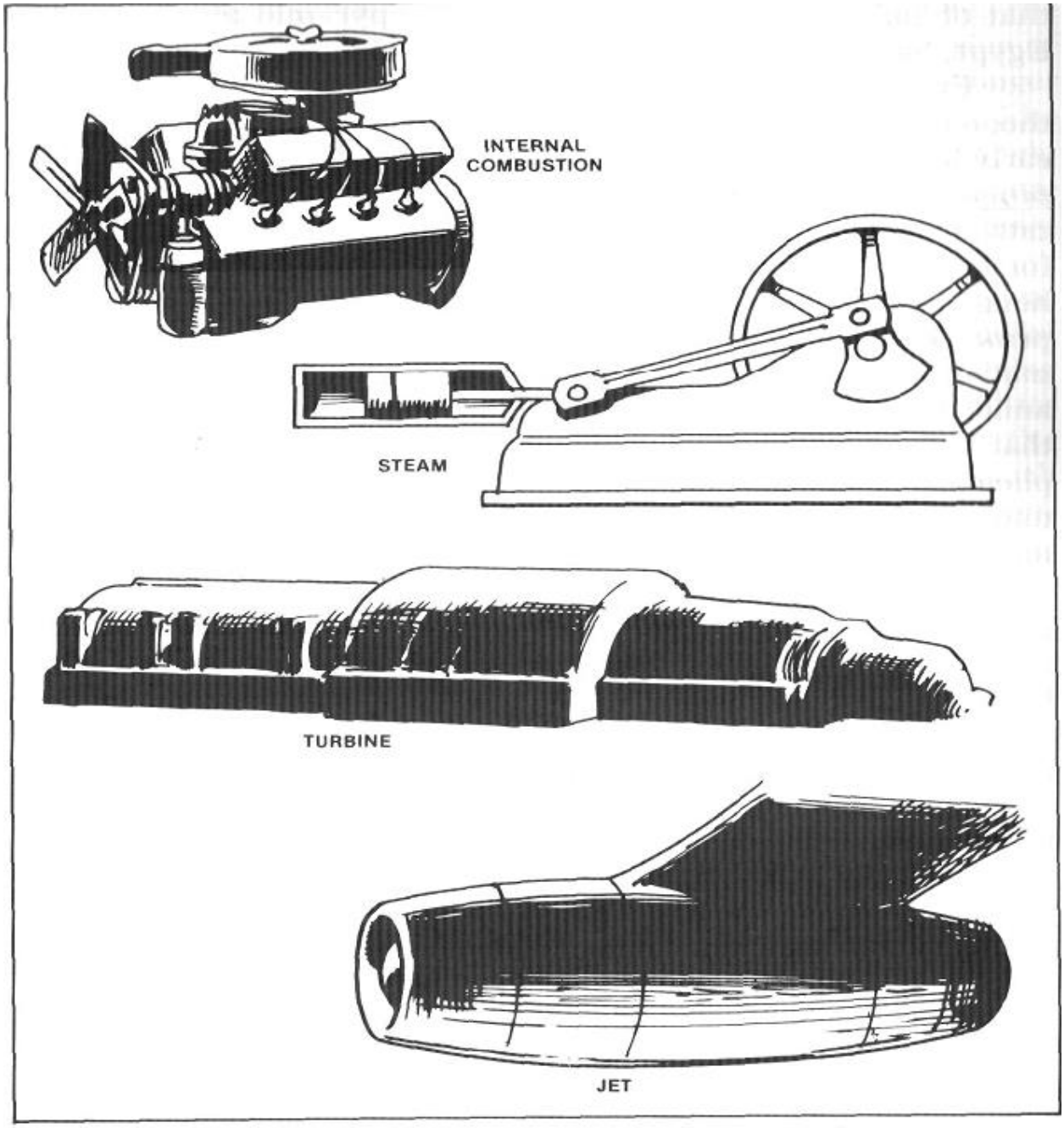
Методичні вказівки складаються з 20 професійно-орієнтованих тем. Кожна тема містить автентичні англомовні тексти за фахом та розроблені до них вправи (некомунікативні, умовно-комунікативні, комунікативні). Це вправи та завдання на словотворення, перефразування, тлумачення окремих технічних термінів, переклад з української мови на англійську та навпаки, на відпрацьовування мовленнєвих навичок і вмінь використання лексичного матеріалу, що вивчається в ситуаціях реального спілкування.

Розвиваючи інтерес студентів до вивчення іноземної мови розроблені методичні вказівки сприятимуть підвищенню ефективності освітнього процесу.

Text 1

The Engineering Profession

Engineering is one of the oldest occupations in history. Without the skills included in the broad field of engineering, our present-day civilization never could have **evolved**.



Some common machines.

Engineering is often defined as making practical application of theoretical sciences such as physics and mathematics. The great engineering works of ancient times were constructed and operated largely by means of **slave labor**.

During the Middle Ages people began to seek devices and methods of work that were more efficient and humane. Wind, water, and animals were used to provide energy for some of these new devices. This kind of experimentation eventually led to what is known as the Industrial Revolution which began in the eighteenth

century. First steam engines and then other kinds of machines took over more and more of the work that had previously been done by human beings or by animals. James Watt, one of the key figures in the early development of steam engines, **devised** the concept of horsepower to make it easier for his customers to understand the amount of work his machines could perform.

The Industrial Revolution began by putting water and steam to work; since then machines using electricity, gasoline, and other energy sources have become so widespread that they now do a very large proportion of the work of the world.

One result of the **rapid expansion** of scientific knowledge was an increase in the number of engineering specialties. By the end of the nineteenth century not only were mechanical, civil, and **mining** and metallurgical **engineering** established but the newer specialties of chemical and electrical engineering **emerged**. This growth in the number of specialties is continuing with the establishment of such disciplines as aerospace, nuclear, **petroleum**, and electronic **engineering**. Many of these are subdivisions of earlier specialties—for example, electronic from electrical engineering or petroleum from chemical. Within the field of mechanical engineering the major subdivision is industrial engineering which **is concerned with** complete mechanical systems for industry rather than individual machines.

Another result of the increase of scientific knowledge is that engineering has become a profession. Until the nineteenth century engineers were for the most part **craftsmen** or **project organizers** who learned their skills through **apprenticeship**, on the job training, or simply by **trial and error**. Today it requires at least four or five years of university study leading to a Bachelor of Science degree. More and more often engineers, especially those **engaged in** research; get an **advanced master's** or doctor's **degree**. Even those engineers who do not study for advanced degrees must **keep up with changes** in their profession and those related to it. A mechanical engineer who does not know about new materials cannot successfully compete with one who does. All of this means that an engineer's education is never really finished so he or she must **be willing to** continue the learning process.

The word engineer is used in two senses in English. One, as just indicated, **refers to** the professional engineer who has a university degree and an education in mathematics, science, and one of the engineering specialties. Engineer, however, is also used to describe a person who operates or **maintains** an engine or machine.

The systems that engineers produce must be workable not only from a technical but also from an economic point of view. This means that engineers work with management and government officials who are **cost-conscious** so the engineer must accommodate his or her ideas to the financial realities of the particular project.

Today, however, people **are** more **conscious** of the hidden or delayed **hazards** in products and processes. The automobile is a typical example. No one disputes its convenience but many are also aware of the air pollution it causes and the amount of energy it consumes. Engineers are working to solve these problems by designing devices that reduce pollution and improve fuel efficiency. The engineer, then, does not work in a scientific vacuum but must take into account the social consequences

of his or her work. Engineering is described as a profession that finds practical application of theoretical science.

ACTIVE VOCABULARY

to evolve – розвиватися
slave labor – праця рабів
to devise – винаходити
rapid expansion – швидке розширення
mining engineering – гірниче машинобудування
to emerge – з'являтися,
petroleum engineering – нафтове машинобудування
to be concerned with – мати справу з
craftsman – майстер, ремісник
project organizer – організатор проекту
apprenticeship – навчання, учнівство
trial and error – метод спроб і помилок
to be engaged in smth. – займатися чимось
advanced master's degree – ступінь магістра
keep up with changes – встигати за змінами
to be willing to do smth. – бути готовим зробити щось
to maintain – підтримувати, технічно обслуговувати
cost-conscious – економний
to be conscious of - усвідомлювати
hazard – перешкода, загроза, небезпека

TEXT STUDY

Exercise 1. Translate the following words.

Engineering, civilization, modern, occupation, metal, construction, to refine, civil, metallurgical, irrigation, human, practical, physics, empirical, application, science, observation, device, industrial, scientific, mechanical.

Exercise 2. Write out from the text kinds of energy sources and translate them into Ukrainian.

Exercise 3. Put the verbs in alphabetical order. Write out word combinations from the text with the given verb.

To devise, to provide, to perform, to lead, to require, to maintain.

Exercise 4. Complete the sentences.

1. Industrial Revolution began in …….
2. James Watt devised …..
3. The Industrial Revolution began by …….
4. One result of the rapid expansion of scientific knowledge were …….
5. Another result of the increase of scientific knowledge is …….
6. Engineers' apprenticeship requires ……..
7. The word "engineer" is used to describe a person ……
8. Engineering is a profession that …….
9. The systems that engineers produce must be workable from a …. point of view.
10. Industrial engineering is concerned with … .

Exercise 5. Find English equivalents in the text.

1) практичне застосування теоретичних наук;
2) шукати ефективні засоби і методи роботи;
3) надавати (забезпечувати) енергію;
4) ключова фігура;
5) розвиток парових двигунів;
6) наукове дослідження;
7) джерело енергії (потужності);
8) кількість інженерних спеціалістів;
9) вимагати спеціалізовану освіту вищого рівня;
10) ступінь бакалавра наук;
11) дотримуватись змін;
12) успішно конкурувати;
13) продовжувати навчальний процес;
14) працювати і технічно обслуговувати двигун чи машину;
15) бути працездатним з технічної та економічної точки зору;
16)займатися дослідженням;
17) усвідомлювати приховані або уповільнені загрози (небезпеки);
18) споживати енергію;
19) підвищувати ефективність використання палива;
20) займатися практичним застосуванням теорії

Exercise 6. Answer the questions.

1. How is engineering often defined?
2. What was the historical result of experimentation with different kinds of energy?
3. Who was James Watt? Why did he devise the concept of horsepower?
4. What advantages have scientific research and its applications given to the mechanical engineer?
5. By the end of the nineteenth century, what engineering specialties were developed?
6. What are some other engineering specialties that have become established since then?
7. What is the major subdivision within the field of mechanical engineering?
8. Why does an engineer need constant new learning?
9. How do the two meanings of the word engineer differ from each other?
10. Discuss two ways in which the systems that engineers produce must be workable.
11. The automobile is a typical example of the public's divided attitude toward engineering projects. Discuss this.
12. What are engineers working on in connection with this problem?

Exercise 7. Translate sentences into Ukrainian.

1. The ZIL Works has already manufactured a new truck model with an engine that is protected against cold. 2. Every object of our industrialized world has practically flown from machine. 3. The construction of the KAMAZ complex within such a short period has become possible only by using the latest achievements of science

and technology. 4. Graduation theses of these students were based on material they had accumulated while working at the Student Design Bureau. 5. Finally, when the planning engineer had ordered the material, the tool engineer had designed the tools and the design engineer had given the specification on the drawings, production began. 6. The chemical engineer will have completed the experiments by the 21st of June. 7. Michael Faraday gathered together and set in order all the work of the scientists who had worked on electrical problems before him.

Text 2

Mechanical Engineering

Mechanical engineering has been recognized as a separate branch of engineering since the formation of the Institution of Mechanical Engineers of Great Britain in 1847. The development of textile machinery, steam engines, machine tools, pumping machinery, turbines, and locomotives **made** such **a diverse interest** for civilian engineers that these and **allied subjects** were called mechanical engineering.

Mechanical engineers design and develop everything you think of – from **supersonic fighter jets** to bicycles to toasters. And they influence the design of other products as well – shoes, **light bulbs** and even doors.

Many mechanical engineers specialize in areas such as manufacturing, **robotics**, automotive/ transportation and air conditioning. Others cross over into other disciplines, working on everything from artificial organs to the expanding field of nanotechnology. And some use their mechanical engineering degree as preparation for the practice of medicine and law. The mechanical engineer may design a component, a machine, a system or a process. Mechanical engineers analyze their design using motion, energy, and force principles to ensure the product functions safely, efficiently, reliably and can be manufactured at a **competitive cost**.

Mechanical engineers work in the automotive, aerospace, chemical, computer, communication, paper, and **power generation industries**. Increasingly, mechanical engineers are needed in the **environmental** and bio-medical **fields**. Indeed, every product or service in modern life has probably been touched in some way by a **mechanical engineer**.

Mechanical engineering is a diverse subject that **derives** its **breadth** from the need to design and manufacture everything from small individual parts and

devices (e.g., **microscale sensors** and **inkjet printer nozzles**) to large systems (e.g., spacecraft and **machine tools**). The role of a mechanical engineer is to take a product from an idea to the marketplace. **To accomplish** this, students need a broad range of skills. The mechanical engineer needs **to acquire** particular skills and knowledge. Students need to understand the forces and the **thermal environment** that a product, its parts, or subsystems will **encounter**. They should design them for functionality, aesthetics, and the ability to withstand the forces and the thermal environment they will **be subjected to**; and determine the best way to manufacture them and ensure they will operate **without failure**. Perhaps the one skill of the mechanical engineer's exclusive **domain** is the ability to analyze and design objects and systems with motion.

Mechanical engineers learn about materials, **solid and fluid mechanics**, thermodynamics, heat transfer, control**, instrumentation**, design, and manufacturing to understand mechanical systems. Specialized mechanical engineering subjects include biomechanics, **cartilage-tissue engineering**, energy conversion, **laser-assisted materials** processing, **combustion**, **MEMS**, microfluidic devices, **fracture mechanics**, nanomechanics, mechanisms, **micropower generation**, tribology, and vibrations.

ACTIVE VOCABULARY

mechanical engineering – машинобудування
to make a diverse interest – викликати різноманітний інтерес
allied subjects – суміжні предмети
supersonic fighter jet – надзвуковий винищувач
light bulb – лампочка
robotics – робототехніка
competitive cost – конкурентоспроможна вартість
power generation industry – промисловість виробництва електроенергії
environmental field – сфера екології
mechanical engineer – інженер-механік
to derive breadth – отримати ширину
microscale sensor – мікромаштабний датчик
inkjet printer nozzle – насадка для струменевого принтера
machine tool – верстат
to accomplish – виконувати
to acquire – набувати, одержувати
thermal environment – теплове середовище
to encounter – зустрічати, стикатися
be subjected to – піддаватися
without failure – без збоїв
domain – домен, галузь, ділянка, виключна сфера
solid mechanics – механіка твердого тіла
fluid mechanics – механіка рідини
instrumentation – приладобудування

TEXT STUDY

Exercise 1. Give the Ukrainian equivalents for the following words and word combinations. Use them in the sentences of your own.

A separate branch of engineering; textile and pumping machinery; manufacturing; automotive transportation; to analyze the design; to acquire particular skills; to withstand the forces; to be subjected to thermal environment; heat transfer; energy conversion.

Exercise 2. Find English equivalents in the text.

Парові двигуни, верстати; проектувати та розробляти; функціонувати безпечно, ефективно, надійно; інженер механік; машинобудування; виробництво; знання і навички; виробляти продукт; працювати без збоїв; розуміти механічні системи; спеціалізовані машинобудівні предмети.

Exercise 3. Answer the following questions using the information from the text.

1. When has Mechanical engineering been recognized as a separate branch of engineering?
2. What was called engineering in the past?
3. What do mechanical engineers design?
4. In what areas do mechanical engineers specialize?
5. In what areas do mechanical engineers work?
6. What skills does mechanical engineer need?

Exercise 4. Translate the following sentences into English.

1. Машинобудування – окрема галузь інженерії.
2. Машинобудування включає та охоплює текстильне і насосне обладнання, верстати, турбіни, двигуни та інші суміжні предмети.
3. Інженери механіки проектують і розробляють багато продуктів, компонентів, машин, систем та процесів.
4. Цей інженер механік працює в автомобільній промисловості.
5. Щоб стати успішними інженерами механіками, студентам потрібно набути широкий спектр навичок і знань.
6. Як інженер механік, я хочу переконатися, що цей продукт функціонує безпечно, ефективно та надійно.
7. Ця система працює без збоїв.
8. Інженери механіки спеціалізуються в різних областях виробництва, і можуть працювати не тільки в офісі, але й на виробництві.

Exercise 5. Fill in the gaps with the appropriate word from the box:

tools	*engineering*	*boilers*	*construction*
machines	*engines*	*automotive*	

Mechanical 1) _____ deals with the design, 2) _____ and operation of machines and devices of all kinds, and with research and sciences upon which these depend. Among these 3) _____ are prime movers such as 4) _____ and turbines using air, gas, steam and water as operating media; pumping machines and other hydraulic apparatus; steam 5) _____, heating, ventilating, air conditioning and refrigerating equipment, transportation structures used in aviation; 6) _____ engineering, railroads and ships, machine-7) _____, special machines for industry and for construction of buildings, railroads and harbours.

Exercise 6. Match the words from the columns to make up phrases.

A	B
1) air	a) field
2) the expanding	b) conditioning
3) the principles of	c) sensors
4) manufacturing	d) tools
5) individual	e) control
6) microscale	f) motion
7) machine	g) printer
8) inkjet	h) system
9) environmental	i) industry
10) cooling	j) parts

Exercise 7. Choose the best alternative to fill in the gaps in each of the following sentences.

1. The basic question is how things _____ and whether they work well.

a) made	b) work	c) used

2. New computer applications make it possible _____ and visualize all of these processes.

a) to assemble	b) to construct	c) to model

3. Mechanical engineers are involved with the mechanics of motion and the _____ of energy from one form to another.

a) moving	b) transfer	c) pulling

4. Mechanical engineering principles are used to _____ and perfect biomechanical devices or systems.

a) design	b) devise	c) pattern

5. Mechanical engineers design and manufacture _____ for mobile, marine, rail, and stationary applications.

a) internal combustion engines	b) integrated circuit engines	c) iron case engines

6. Power Engineering focuses on _____, produced by steam and water-driven turbines.

a) electric system	b) electronics	c) electricity

7. Mechanical Engineers may specialize in the understanding of fuels and _____ in modern utility and industrial power plants or in internal combustion, gas turbine or other engines.

a) burning systems	b) combustion systems	c) combustion engines

8. Mechanical engineers are experts on the conversion and use of existing energy sources and in developing _____ needed to process and transport fuels.

a) the equipment	b) instrument	c) tool

9. The arctic engineer deals with a unique set of problems, such as _____, pipeline operations, and the behavior of materials in cold climates.

a) ice mechanics	b) applied mechanics	c) engineering mechanics

Exercise 8. Use the words and word-combinations in the box to complete the text. Each word can be used just once.

design	generators	tools	production	mechanical
functions	processes	combustion	modeling	manufacturing

Mechanical engineers research, 1) _____ , develop, manufacture, and test tools, engines, machines, and other 2) _____ devices. Mechanical engineering is one of the broadest engineering disciplines. Engineers in this discipline work on power-producing machines such as electric 3) _____ , internal 4) _____ engines, and steam and gas turbines. They also work on power-using machines such as refrigeration and air-conditioning equipment, machine 5) _____ , material handling systems, elevators and escalators, industrial production equipment, and robots used in 6) _____ . Mechanical engineers also design tools that other engineers need for their work. In addition, mechanical engineers work in manufacturing or agriculture 7) _____ , maintenance, or technical sales; many become administrators or managers. Analysis, design, and synthesis are the key 8) ____ of mechanical engineers. The question is often how devices and 9) _____ actually work. The first step is to visualize what is happening and clearly state the problem. A mechanical engineer will then use computer-based 10) _____, simulation, and visualization techniques to test different solutions.

Exercise 9. Make up sentences from the following words and phrases and translate them into Ukrainian.

1. Mechanics can be applied / water, the human skeleton, or complex systems / to almost anything – metal bars, rocks, / such as buildings, automobiles, / and machines.

2. The basic question / work and / whether they / is how things / work well.

3. New computer applications / and visualize all of / make it possible to model / these processes.

4. Engineering technicians / and technologists / alongside engineers / work as part of a team.

5. Mechanical engineering / design, develop, test / technologists help / and manufacture tools / mechanical engineers.

6. Mechanical engineering / in plants and factories / in all sections of the country / technicians work.

Text 3

Careers in Mechanical & Manufacturing Engineering

Careers in Mechanical and **Manufacturing Engineering** range over a broad scope. Mechanical and **manufacturing engineers** research, design, build, test, **maintain** and improve all manner of things. These include **power plants**, **renewable energy systems** and electrical generators, robots, computer systems and aircraft engines and cars.

In recent times, mechanical and manufacturing engineers have had to adapt to the changing needs of the technology era. Now they design **bionic limbs** and **prosthetic joints**, develop high performance composite materials and work on more flexible manufacturing processes. As technology demands it, these engineers **respond with** an ingenious invention or more efficient process.

Aerospace Engineers design, manufacture, test, repair and maintain aircraft. They find careers in fields ranging from defense to commercial airlines, and research to **financial risk assessment**.

Manufacturing Engineers are experts in industrial production. They research and develop methods of designing, building and **shipping** products on time and within budget.

Mechanical Engineers turn energy into power and motion through the design of clever systems. They work in industries ranging from automotive to aerospace and robotics to medicine.

Mechatronic Engineers create smart, innovative machines that **are aware of** their surroundings and can make decisions. Any industry requiring the use of **AI** and/or robotics has need of their skills and services.

ACTIVE VOCABULARY

Manufacturing Engineering – виробниче машинобудування
manufacturing engineer – інженер-технолог
to maintain – обслуговувати, ремонтувати
power plant – електростанція
renewable energy system – система відновлюваної енергетики
bionic limbs – біонічні кінцівки
prosthetic joints – протезування суглобів
to respond with – відповідати
financial risk assessment – оцінка фінансового ризику
shipping – доставка

mechatronic engineer – інженер-мехатронік
to be aware of – усвідомлювати
AI (artificial intelligence) – штучний інтелект

TEXT STUDY

Exercise 1. Find English equivalents in the text.

Машинобудування; інженер механік; виробниче машинобудування; інженер технолог; електростанція; електричні генератори; пристосовуватись до змінних потреб технології; охоплювати широкий діапазон; проектувати біонічні кінцівки; займатися протезуванням суглобів; розробляти високоефективні матеріали; ремонтувати і обслуговувати літаки; промислове виробництво; перетворювати енергію в потужність та рух; розумні машини; приймати рішення; вміння та послуги; штучний інтелект.

Exercise 2. Complete the sentences choosing their corresponding parts in the right column.

1. Aerospace Engineers ….	… turn energy into power and motion through the design of clever systems.
2. Mechanical Engineers …	… research and develop methods of designing, building and shipping products.
3. Mechatronic Engineers …	… work in automotive, aerospace, robotics, medicine industries.
4. Manufacturing Engineers …	... create smart, innovative machines.
5. Aerospace Engineers ….	… are experts in industrial production.
6. Manufacturing Engineers …	… design, manufacture, test, repair and maintain aircraft.
7. Mechatronic Engineers …	… work in defence, commercial airlines, research.
8. Mechanical Engineers …	… work in industries requiring AI and robotics.

Exercise 3. Use the verbs *design, build, research, test, maintain, develop, manufacture* in your own sentences.

Exercise 4. Answer the questions using the information from the text.

1. What careers are there in mechanical engineering?
2. What do mechanical engineers do?
3. What can mechanical engineers design now?
4. Explain the functions or tasks of mechanical, manufacturing, mechatronic, aerospace engineers.
5. What kind of engineer would you like to be?
6. In what industry would you like to work?

Text 4

Mechanical Engineers

The engineer **typifies** the twenty-first century. He is **making a vast contribution** in design, engineering and **promotion**. In the organization and direction of **large-scale enterprises** we need his analytical frame of mind. We need his imagination.

He is either designing the product itself or inventing new products or testing the product, its components, and the materials in it; or analyzing its **performance** and making a mathematical analysis.

He may **be engaged in** the development of the new product, **making drawings and specifications**.

He may be **concerning himself with** the development of a new production process, or the adaptation of a current process to a new product.

He may be **utilizing** his engineering know-how in determining the best processes and equipment for the mass production of high-quality products.

He may be the project engineer **in charge of** the design and **installation** of a highly automatic conveyer system for **handling** different kinds of parts between various **assembly systems**.

He may be working on designing and developing tools, **dies, jigs**, **assembly fixtures, welding fixtures** for the production of an automotive body.

In the 21st century the engineer has **at his command** many new **sources of power**. He works much to develop better materials especially new **alloys** for special purposes. He wants to make all **machinery** automatic.

ACTIVE VOCABULARY

to typify – бути представником, бути прикладом
to make a vast contribution in design – робити величезний внесок у проектування
promotion – сприяння у продажу
large-scale enterprise – великомасштабне підприємство
performance – продуктивність
to be engaged – бути задіяним
to make drawings and specifications – робити креслення та детальний опис
to concern oneself with – займатися
to utilize – використовувати
in charge of – відповідальний за
installation – установка,
to handle – обробляти, керувати

assembly system – система складання
dies, jigs –вузли (штампи), пристосування
assembly fixtures – набір кріплення, монтажні пристосування
welding fixtures – зварні з'єднання,
at one's command – у розпорядженні
alloy – сплав
machinery – техніка, устаткування

TEXT STUDY

Exercise 1. Translate into Ukrainian the following international words and word-combinations.

a) contribution, organization, direction, analytical, to test, component, to analyze, analysis, specifications, adaptation, project, conveyer, assembly, station, command, special.

b) mechanical engineers, engineering and promotion, a mathematical analysis, the development of a new production process, engineering know-how, high-quality products, a highly automatic conveyer system, different kinds of parts, for the production of an automotive body, new sources of power.

Exercise 2. Complete the following sentences and translate them.

1. The engineer may be designing…
2. The engineer may be analyzing…
3. The engineer may be inventing…
4. The engineer may be testing…
5. He may be concerning himself…
6. He may be utilizing…
7. He may be working…

Exercise 3. Complete the sentences choosing their corresponding parts in the right column.

1. The engineer typifies…	…the products' performances.
2. He makes a great contribution…	…deals with the automation of production processes.
3. His main functions are…	… the 21th century.
4. The engineer also analyses…	…the designing office, in the lab and in the production field of engineering.
5. So he can work in…	…designing, developing and testing the products.
6. At present the engineer…	…the analytical frame of mind and imagination.
7. The work of the engineer requires…	…to progress.

Exercise 4. Find English equivalents in the text.

Існуючий процес; джерела енергії; установка; вузли, сплави; наполегливо працювати; ивідповідальний за; мати у своєму розпорядженні; інженерне вміння; робити математичний аналіз; розробка нового продукту; масове

виробництво високоякісної продукції; інженер пректу; автомобільний кузов; сплави спеціального призначення;зробити техніку автоматичною.

Exercise 5. Answer the questions.

1. The engineer typifies the 21st century. Do you agree with this statement? Why?
2. What can mechanical engineer design, invent and test?
3. May the mechanical engineer be a project engineer?
4. Where does mechanical engineer utilize his know-how?
5. Do you know what sources of power the engineer has at his command?
6. What is the main task of mechanical engineer?

Exercise 6. Translate into English.

1. Цей інженер робить величезний внесок у проектування. 2. Ми використовуємо лише нове обладнання на нашому заводі. 3. Петро робив креслення та детальний опис цього виробу цілий день. 4. Сьогодні інженер має у своєму розпорядженні багато нових джерел енергії. 5. Для розвитку національної економіки необхідно модернізувати всі великомасштабні підприємства. 6. Він буде займатися проектуванням обладнання для масового виробництва. 7. Інженер служить прикладом 21 століття. 8. Мій друг працює над адаптацією існуючого процесу відповідно до вимог сучасного виробництва. 9. Наш інженер проекту був задіяним у розробці високоякісних виробів. 10. Він буде натхненно працювати, щоб винайти нові сплави.

Text 5

My Future Profession

Let me introduce myself to you. I'm ... I'm a third-year student of Kovel industrial-economic applied (professional) college. I study at the Mechanical Engineering Faculty.

As for me, my future specialty is Machine-Building Engineering. I have chosen this profession because machines occupy a special place among outstanding man-made inventions. It can be said that without machines a human being would have never become the master of nature. And the **principal purpose** of Machine-Building Engineering is **to master** the processes of machine manufacturing. It is known that the range of problems facing mechanical engineering is very wide. Modern machines, that is machine tools with numerical program control, automobiles, airplanes, etc. are so complicated that it is not always easy to come to know their principal design. But mechanical engineer's task is not only to understand but also to perfect the machine **structural arrangement**.

Machine-building industry supplies equipment to all industries and effects the level of the development of modern society.

To become highly-skilled specialists we are taught a number of general subjects, such as Mathematics, Physics, Philosophy, Psychology, English and special subjects: **Descriptive Geometry**, Welding Processes, **Metal Working Processes, Machine Construction** and many others. We also study different kinds

of machine-tools, for example: **lathes, grinding machines, drilling machines, boring machines, milling machines** and so on.

Our laboratories are equipped with machine-tools. We design, then make **pilot samples** and operate engineering models.

Our graduates can work in different spheres of human activity (management, designing and **research development**). The level of their knowledge is high enough to work at almost any enterprises. I'll do my best to become a **highly-skilled engineer** and work according to my speciality

ACTIVE VOCABULARY

principal purpose – основне призначення, мета
to master – опанувати
structural arrangement – структурне розташування
Descriptive Geometry – нарисна геометрія
Metal Working Processes – металообробні процеси
Machine Construction – машинобудування
lathe – токарний верстат
grinding machine – шліфувальний верстат
drilling machine – свердлильний верстат
boring machine – розточувальний верстат
milling machine – фрезерний верстат
pilot sample – пілотний зразок
research development – розробка досліджень
highly-skilled engineer – висококваліфікований інженер

TEXT STUDY

Exercise 1. Read and translate the words.

Mechanical, faculty, speciality, engineering, profession, machine, modern, structural, standard, utilization, expert, know-how, specialist, model, sphere, activity, center, special, program control.

Exercise 2. Give the Ukrainian equivalents for the following words and word combinations. Use them in the sentences of your own.

Second-year student, engineer's task, man-made, highly-skilled, to be equipped with, the level of knowledge, a number of, pilot sample, machine-tools, to do one's best.

Exercise 3. Complete the sentences with the missing information.

1. My future specialty is … .
2. Mechanical engineer's task is … .
3. Machine building industry… .
4. Our laboratories are equipped … .
5. Our graduates work … .

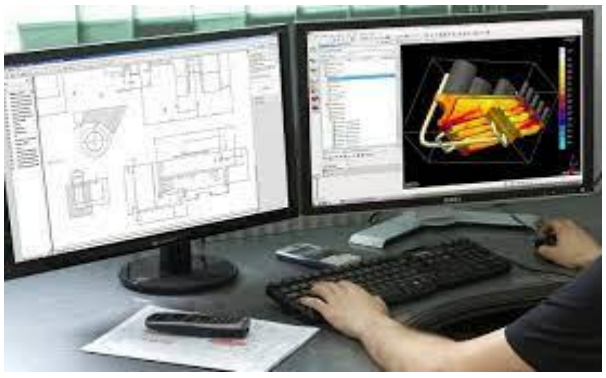
Exercise 4. Speak about your future profession.

1. I suppose.
2. It's true that.
3. I am sure that.
4. In my opinion.
5. I'd like to say, etc.

Exercise 5. Translate into English.

1. Я – студент коледжу за спеціальністю Галузеве машинобудування.
2. Ми обрали цю професію тому, що це перспективна та добре оплачувана робота.
3. Завдання механіка – розуміти, знати та працювати із сучасними машинами і верстатами.
4. Щоб стати висококваліфікованим спеціалістом, я вивчаю ряд загальних та спеціальних предметів.
5. Наші майстерні та лабораторії оснащені верстатами і персональними комп'ютерами.
6. Після закінчення коледжу ми можемо працювати майже на будь-якому підприємстві у різних галузях національної економіки.

Text 6



Computer Aided Design in Engineering

Computer Aided Design (CAD) is a computer-based technology that allows a designer to draw and **label** the engineering details of a product or project electronically on a computer screen while **relegating drawing reproduction** to a printer or X-Y plotter. It also permits designers in different locations to collaborate in the design process via a computer network and permits the drawing to be stored digitally in computer memory **for ready reference**.

CAD has done for engineering graphics what the **word processor** did for writing. The introduction of CAD in the late 1960s changed the traditional method of **drafting** forever by **relieving** the designer of the **time-consuming tasks** of manual drawing from **scratch, inking**, and **dimensioning** on a conventional **drawing board**.

While CAD offers many **benefits** to designers or engineers never before possible, it does not relieve them of the requirement for extensive technical training and **wide background knowledge** of drawing standards and practice if professional work is to be accomplished. Moreover, in making the **transition** from the drawing board to the CAD workstation, the designer must spend the time and make the effort to master the complexities of the specific CAD software systems in use, particularly how to make the most effective use of the icons that appear on the screen.

Another transition is required for the designer moving up from 2D to 3D drawing, **contouring**, and **shading**. The D in CAD stands for design, but CAD in its present state is still essentially "computer-aided drawing" because the user, not the computer, must do the designing. Most commercial CAD programs permit **lettering**, **callouts**, and the **entry of notes** and **parts lists**, and some even offer the capability for calculating such physical properties as volume, weight, and center of gravity if the drawing meets certain **baseline criteria**. Meanwhile, CAD software developers are busy adding more automated features to their systems to move them closer to being true design programs and more **user-friendly**. For example, CAD techniques now available can perform analysis and simulation of the design as well as generate manufacturing instructions. These features **are** being **integrated** with the code for modeling the form and structure of the design.

PCs that include high-speed microprocessors, Windows operating systems, and sufficient RAM and hard-drive capacity can now **run software** that rivals the **most advanced custom** Unixbased products of a few years ago. Now both 2D and 3D CAD software packages provide professional results when **run on off the-shelf personal computers**. The many options available in commercial CAD software include:

- 2D drafting
- 3D **wireframe and surface modeling**
- 3D **solid modeling**
- 3D **feature-based solid modeling**
- 3D hybrid surface and solid modeling

New concepts in rapid prototyping (RP) have made it possible to build many different kinds of 3D prototype models faster and cheaper than by traditional methods. The 3D models **are fashioned automatically** from such materials as plastic or paper, and they can be full size or **scaled-down versions** of larger objects. Rapid- prototyping techniques make use of computer programs derived from computer-aided design (CAD) drawings of the object.

ACTIVE VOCABULARY

Computer Aided Design (CAD) – автоматизоване проектування (САПР)
to label – позначати
to relegate drawing reproduction – передавати репродукцію малюнка
reference – посилання, довідка; for ready reference – для зручного посилання
word processor – текстовий редактор
drafting – креслення
to relieve – звільняти
time-consuming task – трудомістке завдання
from scratch – з нуля
inking – чорнило
dimensioning – визначення розмірів
drawing board – креслярська дошка
benefits – переваги
wide background knowledge – широкі знання
transition – перехід

contouring – нанесення контурів
shading – ретушування
lettering – написи
callout – зноска
entry of notes – введення приміток
parts lists –списки деталей
baseline criteria – базові критерії
user-friendly – зручний для користувача
to be integrated – інтегруватися
to run software – запускати програмне забезпечення
the most advanced custom product – найбільш досконалий користувацький продукт
to run on off the- shelf personal computer – працювати на готовому персональному комп'ютері
wireframe modeling – каркасне моделювання
surface modeling – поверхневе моделювання
solid modeling – суцільне моделювання
feature-based solid modeling – суцільне моделювання на основі 3-D функцій
to be fashioned automatically – формуватися автоматично
scaled-down version – зменшена версія

TEXT STUDY

Exercise 1. Give the English equivalents for:

САПР автоматизоване проектування; проектувати на комп'ютерному екрані; зберігати малюнок у цифровому вигляді в пам'яті для зручного використання; традиційний метод креслення; звичайна креслярська дошка; ручне креслення (малювання); стандарти креслення; виконувати проектуванн; обчислювати об'єм, вагу; дизайнерські програми; трьохвимірний прототип моделі.

Exercise 2. Guess the meaning of these words.

Designer; to draw and label the engineering details; different locations; to collaborate; design process; computer memory; computer network; engineering graphics; word processor; technical training; professional work; effective use; 3D drawing; physical properties; generate instructions; high-speed microprocessors; Windows operating system.

Exercise 3. Read the text and decide whether the statements that follow are true or false.

1. Computer Aided Design is a computer-based technology that allows a designer to draw the engineering details of a product.
2. CAD has done for engineering tasks what the word processor did for writing.
3. The introduction of CAD in the late 1980s changed the traditional method of drafting forever.
4. CAD offers no benefits to designers or engineers never before possible.
5. CAD techniques now available can perform analysis and simulation of the design as well as generate manufacturing rules.

6. New concepts in rapid prototyping have made it possible to build many kinds of 3D prototype models faster and cheaper than by common methods.
7. PCs that include high-speed microprocessors can now run software that rivals the most advanced custom Unixbased goods of a few years ago.
8. The 3D models are fashioned manually from such materials as plastic or paper.

Exercise 4. Answer the following questions using the information from the text.

1. What is Computer Aided Design?
2. For what purpose CAD was created?
3. What did the introduction of CAD in the late 1960s change forever?
4. What benefits does CAD offer to designers or engineers?
5. What options are available in commercial CAD software?
6. What do you know about new concepts in rapid prototyping?
7. From what materials are the 3D models fashioned automatically?

Exercise 5. Match the terms with their definitions and translate them into Ukrainian.

1.	absolute coordinates	a)	a 3d technique that projects 2d into 3d shapes along a linear path.
2.	associative dimensions	b)	a coordinate system that locates points with an angle and radial distance from the origin, considered to be the center of a sphere.
3.	Cartesian coordinates	c)	a 3d technique for projecting 2d into 3d shapes along a circular path.
4.	function	d)	a method of dimensioning in cad software that automatically updates dimension values when dimension size is changed.
5.	linear extrusion	e)	a flexible curve that can be drawn to connect a series of points in a smooth shape.
6.	parametric modeling	f)	distances measured from a fixed reference.
7.	polar coordinates	g)	a task in a cad program that can be completed by issuing a set of commands.
8.	prototype drawing	h)	cad software that links the 3d drawing on the computer screen with data that sets dimensional and positional constraints.
9.	radial extrusion	i)	a rectangular system for locating points in a drawing area in which the origin point is the 0,0 location and *x* represents length, *y* width, and *z* height.

10.	spline	j)	a master drawing or template that includes preset computer defaults so that it can be reused in other applications.
11.	software	k)	tools, equipment
12.	hardware	l)	the programs and other operating information used by a computer

Text 7

Reliability

Reliability is a basic requirement of any instrument, plant or machine. The most ingenious machine is nothing but useless unless it is reliable.

At present the main defect in any machine is the different **service life** of its parts. The first to break down are parts with **friction**, the most numerous in any machine. Until quite recently scientists differed in their explanations of why parts **subjected to** friction break.

At present scientists **are engaged in** research into friction and **wear-and-tear resistance**. The results of their **comprehensive** research will extend the **useful life of units** with friction by thirty to fifty percent as compared with what we have now.

Sufficient reliability and long service life of highly complicated automatic complexes, spaceships and assembly lines can be **ensured** by the high quality of their components, their **accurate assembly** and continuous checking while in operation, as well as by **detecting faults** as soon as they appear. This means that instruments are necessary for checking metal **billets**; all kinds of test installations and **multiple switching control devices** by which temperature, pressure and **density** in any part of a system may be inspected a number of times over a period of only one second. We need diagnostic systems and many different types of **flaw detectors** and **sensors** because, as it known, reliability is the key which opens the way to large-scale automation.

ACTIVE VOCABULARY

reliability – надійність
service life – термін служби
friction – тертя
subjected to – піддаватися
to be engaged in – займатися
wear-and-tear resistance – зносостійкість
comprehensive – об’ємний, комплексний
useful life of units – корисне використання агрегатів
sufficient – достатній
to ensure – гарантувати, забезпечувати
accurate assembly – точна збірка
to detect faults – виявити несправність
billet – заготовка

multiple switching control devices – багаторазові комутаційні контрольні пристрої
density – щільність
flaw detector – дефектоскоп
sensor – датчик

TEXT STUDY

Exercise 1. Put the words into alphabetical order and translate them.

Reliability, requirement, ingenious, defect, friction, numerous, comprehensive, automatic, spaceships, faults, installations, types, key, automation.

Exercise 2. Find equivalents in the text.

Надійна машина; основна вимога; головний недолік; різний термін служби деталей; піддаватися тертю; займатися дослідженням зносостійкості; об'ємне дослідження; гарантувати високу якість; точна збірка; тестове обладнання; перевірити температуру, тиск, щільність; великомаштабна автоматизація.

Exercise 3. Answer the questions.

1. What's reliability?
2. Why is the service life of different machine parts different?
3. What factors do the service life and reliability of complicated systems depend on?
4. In what ways can the quality of machine parts be inspected?
5. Why do we need diagnostic systems, flaw detectors and sensors?

Exercise 4. Choose the necessary word and put it in the sentence.

1. The main defect in any machine is the different … of its parts.
2. The first to break down are parts with … , the most numerous in any machine.
3. Sufficient reliability can be … by the high quality of their components.
4. … is the key which opens the way to large-scale automation.
5. Reliability is … of any instrument, plant or machine.
6. Scientists … research into friction and wear-and-tear resistance.
7. To ensure sufficient reliability we need …. and many different types of flaw detectors and sensors.

1. to be engaged in
2. diagnostic systems
3. service life
4. to ensure
5. reliability
6. a basic requirement
7. friction

Exercise 5. Translate into English.

1. Цей науковець займається дослідженням тертя та зносостійкості.
2. Надійність – основна вимога будь-якого інструменту, заводу чи машини і, звичайно, ключ, який відкриває шлях до великомаштабної автоматизації.
3. Найгеніальніша машина непотрібна, якщо вона ненадійна.
4. Головний недолік будь-якої машини – різний термін служби її деталей.

5. Висока якість компонентів, точна збірка, виявлення несправностей як тільки вони з'являються, гарантує достатню надійність і довгий термін служби.
6. Нам потрібні діагностичні системи, датчики, тестове обладнання для перевірки металевих заготовок і для перевірки температури, тиску, щільності в будь-якій частині системи.

Text 8

Engineering Materials

Engineers have to know the best and most economical materials to use. Engineers must also understand the properties of these materials and how they can be worked. There are two kinds of materials used in engineering – metals and non-metals. We can divide metals into **ferrous** and **non-ferrous metals**. The former contain **iron** and the latter do not contain iron. Cast iron and **steel**, which are both **alloys** or mixtures of iron and **carbon**, are the two most important ferrous metals. Steel contains a smaller proportion of carbon than cast iron contains. Certain elements can improve the properties of steel and are therefore added to it. For example, **chromium** may be included **to resist corrosion** and **tungsten** to increase **hardness**. Aluminium, **copper**, and the alloys, bronze and **brass**, are common non-ferrous metals.

Plastics and ceramics are non-metals; however, plastics may **be machined** like metals. Plastics are classified into two types – **thermoplastics** and **thermosets**. Thermoplastics can be **shaped** and reshaped by heat and pressure but thermosets cannot be reshaped because they **undergo** chemical changes as they harden. Ceramics are often **employed** by engineers when materials which can withstand high temperatures are needed.

ACTIVE VOCABULARY

ferrous metal – чорний метал
non-ferrous metal – кольоровий метал
iron – залізо
steel – сталь
alloy – сплав
carbon – вуглець
chromium – хром
to resist corrosion – протидіяти корозії
tungsten – вольфрам
hardness – твердість
copper – мідь
brass – латунь
to be machined – піддаватися механічній обробці
thermoplastics – термопласт
thermoset – реактопласт
to shape – надавати форми, формувати
to undergo – зазнавати

to employ – застосовувати

TEXT STUDY

Exercise 1. Find English equivalents in the text.

Властивості матеріалів; сплав та суміш; покращити властивості; збільшити твердість; протидіяти корозії; зазнавати хімічних змін; витримувати високу температуру; чорний і кольоровий метал; додавати елементи.

Exercise 2. Define what sentences are true, what are false.

1. Engineers must know the properties of engineering materials.
2. All metals can be classified as metals and non-metals.
3. Non-ferrous metals can contain iron.
4. Steels have to contain more carbon than cast iron.
5. Ceramics can resist high temperatures.
6. Thermosets may be machined.
7. Thermoplastics can be shaped and reshaped.

Exercise 3. Answer the questions.

1. Name two kinds of materials used in engineering.
2. How are metals classified?
3. What's the difference between ferrous and non-ferrous metals?
4. For what purpose are some elements (such as chromium and tungsten) added to steel?
5. Name two kinds of non-metals.
6. What can you say about plastics' classification and properties?
7. In what cases are ceramics used?
8. What's the difference between steel and cast iron?

Exercise 4. Translate into English.

1. Основними легуючими (alloying) елементами, які використовуються в сталі є нікель, хром (chromium), ванадій (vanadium), молібден (molybdenum) і марганець.
2. Приблизно 60% міді використовується в електротехніці.
3. Латунь, бронза і сплави міді з нікелем – основні мідні сплави.
4. Алюміній зазвичай використовують у сплавах з міддю, кремнієм, магнієм.
5. Хіміки створили багато синтетичних матеріалів, які можна використовувати замість металів.
6. Залежно від властивостей, пластмаси поділяють на термопластичні та термореактивні.
7. Термопласти можна використовувати повторно тому, що вони стають мякими при нагріванні та твердішають при охолодженні.
8. Ми не можемо використовувати реактопласти повторно тому, що вони зазнають хімічних змін і твердіють.
9. Кераміка витримує високі температури і, звичайно, використовується в інженерії.
10. Як ми можемо покращити властивості сталі?

Text 9

Metals

Metals are materials most widely used in industry because of their properties. The study of the production and properties of metals is known as metallurgy.

The separation between the atoms in metals is small, so most metals are **dense**. The atoms are arranged regularly and can slide over each other. That is why metals are **malleable** (can be deformed and bent without fracture) and **ductile** (can be drawn into wire). Metals vary greatly in their properties. For example, lead is soft and can be bent by hand, while iron can only be worked by **hammering** at **red heat**.

The regular arrangement of atoms in metals gives them a crystalline structure. Irregular crystals are called **grains**. The properties of the metals depend on the size, shape, orientation, and **composition** of these grains. In general, a metal with small grains will be harder and stronger than one with **coarse grains**.

Heat treatment such as **quenching, tempering,** or **annealing** controls the nature of the grains and their size in the metal. Small amounts of other metals (less than 1 per cent) are often added to a pure metal. This is called **alloying** and it changes the grain structure and properties of metals.

All metals can be formed by **drawing, rolling,** hammering and **extrusion,** but some require hot-working. Metals are subject to metal fatigue and **to creep** (the slow increase in length under stress) causing deformation and failure. Both effects are taken into account by engineers when designing, for example, airplanes, gas-turbines, and **pressure vessels** for high-temperature chemical processes. Metals can be worked using **machine-tools** such as **lathe, milling machine, shaper and grinder.**

The ways of working a metal depend on its properties. Many metals can be **melted** and **cast** in **moulds**, but special conditions are required for metals that react with air.

ACTIVE VOCABULARY

dense – щільний
malleable – ковкий, кувальний, піддатливий
ductile – гнучкий, пластичний
hammering – кування
red heat – жар
grains – зернасoarse grains – грубі зерна, велика кількість зерна

composition – склад
quenching – гасіння
tempering – загартовування
annealing – відпалювання
alloying – легування
drawing – протягування, креслення
rolling – прокатка
extrusion – витискання
to creep – повзучість
pressure vessels – посудина під тиском
machine-tool – верстат
lathe – токарний верстат
milling machine – фрезерний верстат
shaper – поперечно-стругальний верстат
grinder – шліфувальний верстат
to melt – плавити
to cast – відливати
mould – ковш, форма

TEXT STUDY

Exercise 1. Complete the sentences.

1. Metals are...
2. Metallurgy is...
3. Most metals are...
4. The regular arrangement of atoms in metals...
5. Irregular crystals...
6. The properties of the metals depend...
7. Metals with small grains will be...
8. ...controls the nature of the grains in the metal.
9. Alloying is...
10. All metals can be formed by...
11. Creep is...
12. Metals can be worked using...

Exercise 2. Find English equivalents in the text.

Широко використовуватись у промисловості; властивості металів; мякий метал; чистий метал; термічна обробка металу; повзучість та втомленість металу; хімічні процеси; спосіб обробки металу; плавити метал і відливати у форми; використовувати верстат для обробки металу; спричиняти деформацію і поломку.

Exercise 3. Answer the following questions.

1. What are metals and what do we call metallurgy?
2. Why are most metals dense?
3. Why are metals malleable?
4. What is malleability?
5. What are grains?
6. What is alloying?

7. What is crystalline structure?
8. What do the properties of metals depend on?
9. What changes the size of grains in metals?
10. What are the main processes of metal forming?
11. How are metals worked?
12. What is creeping?

Exercise 4. Translate into English.

1. Метали – щільні матеріали тому, що між атомами в металах мала відстань.
2. Метали мають кристалічну структуру через правильне розташування атомів.
3. Метали з малими зернами – твердіші і міцніші ніж з великими.
4. Загартування й відпалювання змінюють форму й розмір зерен у металах.
5. Легування змінює структуру зерен і властивості металів.
6. Метал деформується й руйнується через утому й повзучість.

Text 10

Steel

The most important metal in industry is iron and its alloy — steel. Steel is an alloy of iron and carbon. It is strong and **stiff,** but **corrodes** easily through **rusting**, although **stainless** and other special steels resist corrosion. The amount of carbon in a steel influences its properties considerably. Steels of low carbon content (**mild steels**) are quite **ductile** and are used in the manufacture of sheet iron, wire, and pipes. **Medium-carbon steels** containing from 0.2 to 0.4 per cent carbon are **tough**er and stronger and are used as **structural steels**. Both mild and medium-carbon steels are suitable for **forging** and **welding**. High-carbon steels contain from 0.4 to 1.5 per cent carbon, are hard and **brittle** and are used in cutting tools, surgical instruments, razor blades and **springs**. Tool steel, also called silver steel, contains about 1 per cent carbon and is strengthened and toughened by **quenching** and **tempering**.

The inclusion of other elements affects the properties of the steel. Manganese gives extra strength and toughness. Steel containing 4 per cent silicon is used for transformer cores or electromagnets because it has large grains acting like small magnets. The addition of chromium gives extra strength and corrosion resistance, so we can get **rust-proof** steels. Heating in the presence of carbon or **nitrogen**-rich materials is used to form a hard surface on steel (**casehardening**). **High-speed steels**, which are extremely important in machine-tools, contain chromium and **tungsten** plus smaller amounts of vanadium, molybdenum and other metals.

ACTIVE VOCABULARY

stiff – жорсткий, цупкий
to corrode – піддаватися корозії
rusting – іржавіння

stainless – нержавіючий
medium-carbon steel – середньовуглецева сталь
mild steel – м'яка сталь
structural steel – конструкційна сталь
high-speed steel – швидкорізальна сталь
rust-proof steel – нержавіюча сталь
ductile – гнучкий, пластичний
tough – міцний, твердий
forging – кування
welding – зварювання
brittle – крихкий, ламкий
spring – пружина
quenching – гасіння, гартування
tempering – загартовування
nitrogen – азот
casehardening – зміцнення корпусу
tungsten – вольфрам

TEXT STUDY

Exercise 1. Complete the sentences.

1. Steel is an alloy of … .
2. Mild steel is a steel of … .
3. Medium-carbon steel is used as … .
4. High-carbon steel is used in … .
5. Silver steel is called … .
6. Steel containing manganese gives … .
7. Steel containing silicon is used for … .
8. Steel containing chromium gives ….
9. We can get rust-proof steels by adding … .
10. High-speed steels are important in … .

Exercise 2. Find equivalents in the text.

1. сплав заліза й вуглецю
2. міцний і твердий
3. легко корозує
4. нержавіюча сталь
5. низький вміст вуглецю
6. ковкість
7. листове залізо, дріт, труби
8. конструкційні сталі
9. придатні для кування й зварювання
10. твердий і крихкий
11. ріжучий інструмент
12. хірургічні інструменти
13. інструментальна сталь
14. зміцнювати
15. додавання марганцю (кремнію, хрому, вольфраму, молібдену, ванадію)

Exercise 3. Answer the following questions.

1. What is steel?
2. What are the main properties of steel?
3. What are the drawbacks of steel?
4. What kinds of steel do you know? Where are they used?
5. What gives the addition of manganese, silicon and chromium to steel?
6. What can be made of mild steels (medium-carbon steels, high-carbon steels)?
7. What kind of steels can be forged and welded?
8. How can we get rust-proof (stainless) steel?
9. What is used to form a hard surface on steel?
10. What are high-speed steels alloyed with?

Text 11

Metalworking Processes

Part I

Metals are important in industry because they can be easily deformed into useful shapes. A lot of metalworking processes have been developed for certain applications. They can be divided into five broad groups:

1) **rolling**;
2) **extrusion**;
3) **drawing**;
4) **forging**;
5) **sheet-metal forming**.

During the first four processes metal is subjected to large amounts of **strain** (deformation). But if deformation goes at a high temperature, the metal will recrystallize — that is, new strain-free grains will grow instead of deformed grains. For this reason metals are usually rolled, extruded, drawn, or forged above their recrystallization temperature. This is called hot working. Under these conditions there is no limit to the **compressive plastic strain** to which the metal can be subjected.

Other processes are performed below the recrystallization temperature. These are called cold working. Cold working hardens metal and makes the part stronger. However, there is a limit to the strain before a cold part cracks.

Rolling

Rolling is the most common metalworking process. More than 90 percent of the aluminum, steel and copper produced is rolled at least once in the course of production. The most common rolled product is sheet. Rolling can be done either hot or cold. If the rolling is finished cold, the surface will be smoother and the product stronger.

Extrusion

Extrusion is pushing the billet to flow through the **orifice** of a **die**. Products may have either a simple or a complex **cross section**. Aluminum window frames are the examples of complex extrusions.

Tubes or other hollow parts can also be extruded. The initial piece is a **thick-walled tube**, and the extruded part is shaped between a die on the outside of the tube and a **mandrel** held on the inside.

In impact extrusion (also called back-extrusion) (штампування видавлюванням), the workpiece is placed in the bottom of a hole and a **loosely fitting ram** is pushed against it. The ram forces the metal to flow back around it, with the gap between the ram and the die determining the wall thickness. The example of this process is the manufacturing of aluminum beer cans.

ACTIVE VOCABULARY

rolling – прокатка
extrusion – витіснення, видавлення, екструзія
drawing – протягування, волочіння
forging – кування
sheet-metal forming – формування листового металу
strain – напруга
compressive plastic strain – пластична деформація стиску
orifice – отвір
die – пуансон, штамп
cross section – перетин
thick-walled tube – труба з товстими стінами
mandrel – оправка, оправлення
loosely fitting ram – нещільно прилягаючий барабан (плунжер)
beer can – пивна бляшанка

TEXT STUDY

Exercise 1. Answer the following questions.

1. Why are metals so important in industry?
2. What are the main metalworking processes?
3. Why are metals worked mostly hot?
4. What properties does cold working give to metals?
5. What is rolling? Where is it used?
6. What is extrusion? What shapes can be obtained after extrusion?
7. What are the types of extrusion?

Exercise 2. Find equivalents in the text.

1. можуть легко деформуватися
2. потрібні (корисні) форми
3. піддавати більшим деформаціям

4. зерна, вільні від деформації
5. температура перекристалізації
6. пластична деформація стиску
7. процес обробки металу
8. виріб прокату
9. отвір фільєри
10. початковий
11. складний перетин
12. пустотілі деталі
13. вільно вхідний плунжер
14. зазор між плунжером (пуансоном) і штампом
15. товщина стінки

Exercise 3. Translate into English.

1. Здатність металу перекристалізовуватися при високій температурі використовується при гарячому обробленні.
2. Перекристалізація – це ріст нових, вільних від деформації зерен.
3. Під час гарячого оброблення метал може зазнати дуже великої пластичної деформації стиску.
4. Холодне оброблення робить метал твердішим і міцнішим, але деякі метали мають межу деформації.
5. Листовий прокат може бути гарячим або холодним.
6. Поверхня холоднокатаного листа більш гладка й він міцніший.
7. Поперечний переріз фільєри для екструзії може бути простим або складним.
8. Алюмінієві й мідні сплави є найкращими для екструзії через їхню пластичність при деформації.
9. Алюмінієві банки, тюбики для зубної пасти є прикладами використання штампування видавлюванням.
10. Товщина стінки алюмінієвої банки визначається зазором між пуансоном і штампом.

Text 12

Metalworking Processes

Part II

Drawing

Drawing consists of pulling metal through a die. One type is wire drawing. The diameter **reduction** that can be achieved in one die is limited, but several dies in series can be used to get the desired reduction.

Sheet metal forming

Sheet metal forming (штампування листового металу) is widely used when parts of certain shape and size are needed. It includes forging, bending and **shearing**. One characteristic of sheet metal forming is that the thickness of the sheet changes little in processing. The metal is stretched just beyond its **yield point** (2 to 4 percent strain) in order to retain the new shape. Bending can be done by pressing between two dies. Shearing is a cutting operation similar to that used for **cloth**.

Each of these processes may be used alone, but often all three are used on one part. For example, to make the roof of an automobile from a flat sheet, the edges are **gripped** and the piece **pulled in tension** over a lower die. Next an upper die is pressed over the top, finishing the forming operation (штампування), and finally the edges are sheared off to give the final dimensions.

Forging

Forging is the shaping of a piece of metal by pushing with open or closed dies. It is usually done hot in order to reduce the required force and increase the metal's plasticity.

Open-die forging is usually done by **hammering** a part between two flat **faces**. Now air or steam hammers are used, since they allow greater control over the force and the **rate of forming**. The part is shaped by moving or turning it between **blows**.

Closed-die forging is the shaping of hot metal within the walls of two dies that **come together to enclose** the workpiece on all sides. With closed dies, parts can be made to close tolerances so that little finish machining is required.

Two closed-die forging operations are given special names. They are **upsetting** and **coining**. Coining takes its name from the final stage of forming metal coins, where the desired **imprint** is formed on a metal disk that is pressed in

a closed die. Coining involves small strains and is done cold. Upsetting involves a flow of the metal **back upon itself**. An example of this process is the pushing of a short length of a rod through a hole, **clamping** the rod, and then hitting the exposed length with a die to form the head of a nail or bolt.

ACTIVE VOCABULARY

reduction – зменшення
shearing – обрізка, різання
yield point – межа текучості
cloth – тканина
to grip – схопити, стиснути, охоплювати
to pull in tension – протягувати в напрузі
open-die forging – відкрите кування
closed-die forging – закрите кування
hammering – биття молотком
face – грань
rate of forming – швидкість формування
blow – удар
to come together – об'єднати
to enclose –охопити
upsetting – осадка, висадження
coining – карбування
imprint - відбиток
back upon itself – назад на себе
clamping – затискання
exposed length – відкрита довжина

TEXT STUDY

Exercise 1. Answer the following questions.

1. How can the reduction of diameter in wire drawing be achieved?
2. What is sheet metal forming and where it can be used?
3. What is close-die forging?
4. What is forging?
5. What are the types of forging?
6. What types of hammers are used now?
7. Where are coining and upsetting used?
8. What process is used in wire production?
9. Describe the process of making the roof of a car.
10. What operation takes its name from the final stage of forming metal coins?

Exercise 2. Find equivalents in the text.

Волочіння дроту; штампування листового металу; форма і розмір деталей; зберегти нову форму деталі; кінцеві розміри деталі; підвищити пластичність металу; заготовка; механічна обробка; виготовлення металевих монет; відбиток поверхні металу; виготовляти голівку цвяха чи болта.

Exercise 3. Translate into English.

1. При волочінні дроту діаметр отвору волочильної дошки щораз зменшується.

2. Штампування листового металу містить у собі кування, вигин і обрізку.
3. Невелика деформація листа при розтяганні допомагає зберегти нову форму деталі.
4. Зміна форми при штампуванні проводиться шляхом стискування між двома штампами.
5. Краї листа при штампуванні відрізаються для одержання кінцевих розмірів.
6. При куванні деталь повинна бути гарячою для зменшення необхідних зусиль і збільшення пластичності металу.
7. Після кування в закритих штампах деталі не вимагають великої механічної обробки.
8. При карбуванні деформація металу невелика й відбиток формується на поверхні металу.
9. Висадження використовується для виготовлення голівок цвяхів і болтів.
10. Висадження і карбування – це дві закриті кувальні операції.

Text 13

Mechanical Properties of Materials
Part I

Materials Science and Technology is the study of materials and how they can be **fabricated** to meet the needs of modern technology. Using the laboratory techniques and knowledge of physics, chemistry, and metallurgy, scientists are finding new ways of using metals, plastics and other materials.

Engineers must know how materials respond to external forces, such as **tension, compression, torsion, bending,** and **shear**. All materials respond to these forces by elastic deformation. That is, the materials return their original size and form when the external force disappears. The materials may also have permanent deformation or they may fracture. The results of external forces are **creep** and **fatigue**.

Compression is a pressure causing a decrease in volume. When a material is subjected to a bending, shearing, or **torsion (twisting) force**, both **tensile and compressive forces** are simultaneously at work.

Tension is a **pulling force**; under tension, a material usually stretches, returning to its original length if the force does not exceed the material's elastic limit. Under larger tensions, the material does not return completely to its original condition, and under greater forces the material **ruptures**.

Fatigue is the growth of cracks under stress. It occurs when a mechanical part is subjected to a repeated or cyclic stress, such as vibration. Even when the maximum stress never exceeds the elastic limit, failure of the material can occur even after a short time. No deformation is seen during fatigue, but small localized cracks develop and **propagate** through the material until the **remaining cross-sectional area** cannot support the maximum stress of the **cyclic force**. Knowledge

of tensile stress, elastic limits, and the resistance of materials to creep and fatigue are of basic importance in engineering.

Creep is a slow, permanent deformation that results from a **steady force** acting on a material. Materials at high temperatures usually suffer from this deformation. The **gradual loosening of bolts** and the deformation of components of machines and engines are all the examples of creep. Creep extended over a long time finally leads to the rupture of the material.

ACTIVE VOCABULARY

Materials Science – матеріалознавство
to fabricate – виготовляти
tension – напруга
compression – компресія, стискання
torsion – скручування
bending – згинання, вигин
shear – обрізка
creep – повзучість
fatigue – втомленість, утома
torsion (twisting) force – сила скручування
tensile force – сила розтягування
compressive force – сила стискання
pulling force – сила тяги
to rupture – розривати
to propagate – розмножувати
remaining cross-sectional area – залишкова площа поперечного перерізу
cyclic force – циклічна сила
steady force – стійка сила
gradual – поступовий
loosening of bolt – відкручування болта

TEXT STUDY

Exercise 1. Answer the following questions.

1. What are the external forces causing the elastic deformation of materials? Describe those forces that change the form and size of materials.
2. What are the results of external forces?
3. What kinds of deformation are the combinations of tension and compression?
4. What is the result of tension? What happens if the elastic limit of material is exceeded under tension?
5. What do we call fatigue? When does it occur? What are the results of fatigue?
6. What do we call creep? When does this type of permanent deformation take place? What are the results of creep?

Exercise 2. Find equivalents in the text.

1. відповідати вимогам сучасної технології
2. використовуючи лабораторні методи
3. нові способи використання металів

4. стиск, розтягання, вигин, крутіння, зріз
5. повертати первісний розмір і форму
6. зовнішня сила
7. постійна деформація
8. зменшення обсягу
9. розтягувальні й стискаючі сили
10. перевищувати межу пружності матеріалу
11. повторювані циклічні напруги
12. руйнування матеріалу
13. розвиток і поширення дрібних тріщин
14. опір матеріалів повзучості й утоми
15. матеріалознавсиво і технологія

Exercise 3. Translate into English.

1. Пружна деформація – це реакція всіх матеріалів на зовнішні сили, такі як розтягання, стискування, скручування, вигин і зріз.
2. Утома й повзучість матеріалів є результатом зовнішніх сил.
3. Зовнішні сили викликають постійну деформацію й руйнування матеріалу. 4. Розтягувальні й стискувальні сили працюють одночасно, коли ми згинаємо або скручуємо матеріал.
4. Розтягання матеріалу, вище від межі його пружності, дає постійну деформацію або руйнування.
5. Коли деталь працює довгий час під циклічними напругами, у ній з'являються невеликі тріщини, що зростають через утому металу.
6. Повзучість – це повільна зміна розміру деталі під напругою.

Text 14

Mechanical Properties of Materials
Part II

Density (specific weight) is the amount of mass in a unit volume. It is measured in kilograms per cubic meter. The density of water is 1000 kg/m3 but most materials have a higher density and sink in water. Aluminium alloys, with typical densities around 2800 kg/ m3 are considerably less dense than steels, which have typical densities around 7800 kg/m3 . Density is important in any application where the material must not be heavy.

Stiffness (rigidity) is a measure of the resistance to deformation such as stretching or bending. Stiffness is important when a rigid structure is to be made.

Strength is the force per unit area (stress) that a material can support without failing. The **yield strength** is the stress at which a material first deforms plastically. For a metal the yield strength may be less than the fracture strength, which is the stress at which it breaks. Many materials have a higher strength in compression than in tension.

Ductility is the ability of a material to deform without breaking. One of the great advantages of metals is their ability to be formed into the shape that is

needed, such as car body parts. Materials that are not ductile are **brittle**. Ductile materials can absorb energy by deformation but brittle materials cannot.

Toughness is the resistance of a material to breaking when there is a crack in it. Toughness is different from strength: **the toughest steels**, for example, are different from the ones with highest **tensile strength**. Brittle materials have low toughness: glass can be broken along a chosen line by first scratching it with a diamond. Composites can be designed to have considerably greater toughness than their constituent materials. The example of a very tough composite is **fiberglass** that is very flexible and strong.

Creep resistance is the resistance to a gradual permanent change of shape, and it becomes especially important at higher temperatures. A successful research has been made in materials for machine parts that operate at high temperatures and under high tensile forces without gradually extending, for example the parts of plane engines.

ACTIVE VOCABULARY

density – густота
stiffness (rigidity) – жорсткість
strength – сила, міцність
yield strength – межа текучості
ductility – пластичність, еластичність
brittle – крихкий
toughness – пружність, міцність
the toughest steel – найміцніша сталь
tensile strength – міцність на розрив
fiberglass – скловолокно

TEXT STUDY

Exercise 1. Answer the following questions.

1. What is the density of a material?
2. What are the units of density? Where low density is needed?
3. What are the densities of water, aluminium and steel?
4. A measure of what properties is stiffness? When stiffness is important?
5. What is strength?
6. What is yield strength? Why fracture strength is always greater than yield strength?
7. What is ductility? Give the examples of ductile materials. Give the examples of brittle materials.
8. What is toughness?
9. What properties of steel are necessary for the manufacturing of: a) springs, b) car body parts, c) bolts and nuts, d) cutting tools?
10. Where is aluminium mostly used because of its light weight?

Exercise 2. Find equivalents in the text.

1. кількість маси в одиниці об'єму
2. кілограм на кубічний метр
3. опір деформації

4. відношення прикладеної сили на одиницю площі до часткової пружної деформації
5. жорстка конструкція
6. міцність на стиск
7. здатність матеріалу деформуватися не руйнуючись
8. поглинати енергію шляхом деформації
9. крихкий матеріал
10. поступова зміна форми
11. підвищені температури
12. високі розтяжні зусилля

Exercise 3. Translate into English.

1. Щільність вимірюється в кілограмах на кубічний метр.
2. Більшість матеріалів мають більш високу щільність ніж вода, й тонуть у воді.
3. Щільність матеріалу дуже важлива, особливо в авіації.
4. Чим твердіший метал, тим менше він деформується під навантаженням.
5. Коли метал розтягують, він спочатку тече, тобто пластично деформується.
6. Свинець, мідь, алюміній і золото –найковкіші метали.
7. Опір повзучості є дуже важливою властивістю матеріалів, які використовуються в авіаційних моторах.

Text 15

Workshop

A **workshop** is a room or building that provides both the area and tools (or machinery) required for the manufacture or repair of **manufactured goods.**

Essential power tools for the workshop: **drills, circular saw, finishing sander, table saw, router, band saw, biscuit joiner, drill press**.

There are many drills: some powered manually, others using electricity or compressed air as the **motive power**, and a minority driven by an internal combustion engine (for example, **earth drilling augers**). Drills with a **percussive**

action (such as **hammer drills**, **jackhammers** or pneumatic drills) are usually used in rigid materials such as **masonry** (brick, concrete and stone) or rock. **Drilling rigs** are used to bore holes in the earth to obtain water or oil. Some types of **handheld drills** are also used **to drive screws**. Some small appliances may be drill-powered, such as small pumps, grinders, etc.

A drill in the shape of a **pistol** is a valuable type of power tool. There is an endless variety of these primary form factor subtypes. The notable exception is the **Right Angle Drill**, a specialty tool used by trade specialists such as **plumbers** and electricians. A **cordless drill** is more convenient but is also quite a bit more expensive that can match the power of an electric drill.

A circular saw is used to **trimming** and performs basic cuts on **timber** and other materials such as concrete, **fibre board**, and metal just by attaching the appropriate blades.

Finishing Sander type generally uses a ¼ piece of **sandpaper** and is used for finish sanding. It's great for smoothing out a surface for painting or finishing.

There are many small, inexpensive table saws out there, but unfortunately, they are **underpowered** and don't work very well.

A router is a tool that's used **to cut a profile** into the edge of a piece of wood. We can also use them to cut **moldings** and unique profiles.

A band saw uses a blade consisting of a continuous **band** of metal with teeth along one edge. The saw may be powered by wind, water, steam, electrical motor or animal power. Band sawing produces uniform cutting action as a result of an evenly distributed tooth load. Band saws can be used for woodworking, metalworking, or cutting a variety of other materials and are particularly useful for cutting irregular or curved shapes but can also be used to produce straight cuts.

A biscuit joiner is an excellent tool for joining together pieces of wood. The tool cuts a small slot in each side of a joint, and a biscuit is inserted and glued in place to hold the parts together. A biscuit joiner can speed up the assembly of a project.

ACTIVE VOCABULARY

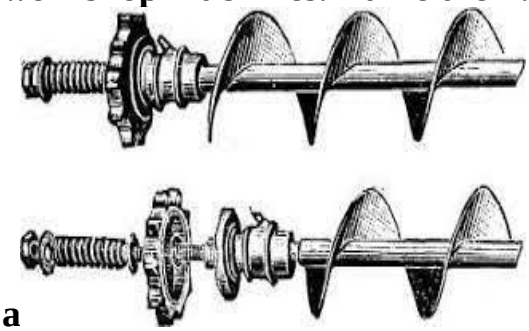
workshop – майстерня
manufactured goods – вироблені товари
drill – дриль
circular saw – циркулярна пила
finishing sander – фінішна шліфувальна машина
table saw – настільна пила
router – фрезер
band saw – стрічкова пила
biscuit joiner – клейка
drill press – свердлильний прес
motive power – рушійна сила
earth drilling auger – шнеки для буріння землі
percussive action – ударна дія
hammer drill – перфоратор
jackhammer – відбійний молоток

masonry – кам’яна кладка
drilling rig – бурова установка
handheld drill – ручна дриль
to drive screw – закручувати гвинт
pistol – пістолет
Right Angle Drill – свердло під прямим кутом
plumber – сантехнік
cordless drill – дриль акумуляторна
trimming – обрізка
timber – деревина
fibre board – ДВП (деревинноволокниста плита)
sandpaper – наждачний папір
to be underpowered – мати недостатню потужність
to cut a profile – вирізати профіль
molding - ліпнина
band – стрічка

TEXT STUDY

Exercise 1. It is important for a mechanic to know different kinds of workshop machines. Name them.

a



b

c

d

e

f

g

h

i

Exercise 2. Match the following questions (1-6) about the workshops with the answers (a-f):

1) What is a mechanical workshop?	**a)** There are four basic production processes for producing desired shape of a product. These are casting, machining, joining (welding, mechanical fasteners, epoxy, etc.), and deformation processes. With the application of suitable pressures, the material is moved to obtain the desired shape with almost no wastage.
2) What is mechanical workshop layout?	**b)** The workshop is primarily responsible for machine processing of various metals, plastics, and a variety of special materials. The equipment is state-of-the-art and designed for multiple uses.
3) What is the purpose of mechanical workshop?	**c)** Workshop is the core of learning about different Materials, equipment, tools and manufacturing practices that are observed in different manufacturing functions and operations. Workshop is also of prime importance when you want to gather about the practical knowledge.
4) What are the basic workshop processes?	**d)** The workshop layout is the art of planning and positioning the machine tools, equipment, allied equipment, employee amenities, and other required utilities/spaces to achieve maximum utilization of labor, machinery, and space and increase the overall efficiency.
5) What happens in a mechanical workshop?	**e)** Mechanical Engineering Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing and production. The Workshop Practice course makes students competent in handling practical work in engineering environment.
6) What is manufacturing process in workshop?	**f)** Drilling, Boring, Planning, Shaping, Sawing, Milling, Grinding, Slotting, etc. These processes are used for joining metal parts and in general fabrication work.

Exercise 3. Read the text again and decide whether the following statements are true or false. Correct the false statement.

1) A biscuit joiner is an excellent device for joining together pieces of wood.
2) Band sawing produces uniform cutting action as a result of an evenly distributed tooth load.
3) A router is a tool that's used to drill a profile into the edge of a piece of

wood.	
4)	Drilling rigs are used to band holes in the earth to obtain water or oil.
5)	Table saw is used for finish sanding.
6)	A cordless drill is more convenient but is also quite a bit more expensive.
7)	Some types of hand-held drills are also used to drive screws.

1) __	**2) ___**	**3) ___**	**4) ___**	**5) ___**	**6) ___**	**7) ___**

Exercise 4. Find the definition to the terms that are given below:

drill press, shaft, biscuit joiner, flexibility, workbench, swing, spindle, pillar

1	a tool used to cut slots into pieces of wood so that they can be joined using a biscuit
2	a machine tool for drilling holes, set on a fixed stand
3	a pin or rod used on a spinning wheel to twist and wind the thread
4	move or cause to move back and forth or from side to side while suspended or on an axis
5	a tall vertical structure of stone, wood, or metal, used as a support for a building, or as an ornament or monument
6	a bench at which carpentry or other mechanical or practical work is done
7	the quality of bending easily without breaking
8	a long, narrow part or section forming the handle of a tool

Exercise 5. Match the terms from column A with their definitions in column B. Translate these terms into Ukrainian.

1) steel	a) make or form (something) by using a sharp tool to remove material
2) sliver	b) beneficial; useful
3) circular saw	c) a power saw with a rapidly rotating toothed disc
4) profitable	d) the most active or crowded part of something
5) hammer drill	e) a hard, strong grey or bluish-grey alloy of iron with carbon and usually other elements, used as a structural and fabricating material
6) the cutting	f) a projecting part on a tool or other instrument, especially one of a series that function or engage together, such as a cog on a gearwheel or a point on a saw
7) pneumatic drill	g) a small, thin, narrow piece of something cut or split off a larger piece
8) the tooth	h) a large, heavy mechanical drill driven by compressed air, used for breaking up a hard surface such as a road

9) a thick	i) a power drill that works by delivering a rapid succession of blows, used chiefly for drilling in masonry or rock
10) automatic drill	j) a straight brace for bits the shank of which consists of a screw of very coarse pitch slidind withing a correspondingly threaded tube or pipe having a handle at the end hathe tool being actuated by pushing the handle

Exercise 6. Choose the best alternative to fill in the gaps in each of the following sentences.

1) A drill press is a fixed style of _____ that may be mounted on a stand or bolted to the floor or workbench.

a) drill b) drilling c) table

2) A drill press consists of a base, column, table, _____ and drill head, usually driven by an induction motor.

a) gear b) spindle c) screw

3) The _____ has a set of handles radiating from a central hub that, when turned, move the spindle and chuck vertically, parallel to the axis of the column.

a) steam b) speed c) head

4) The size of a drill _____ is typically measured in terms of swing.

a) press b) shape c) join

5) Swing is defined as twice the throat _____, which is the distance from the center of the spindle to the closest edge of the pillar.

a) side b) distance c) floor

6) Drill presses are often used for miscellaneous _____ tasks such as sanding, honing or polishing.

a) room b) workshop c) garage

7) A drill press is great for drilling consistent holes in wood, however the limited depth makes them less useful for woodworking than _____ .

a) workpiece b) metalworkin c) machine

8) The best _____ for a drill press are when you are working with small parts.

a) uses b) work c) consist

Text 16

Machine-Tools

Machine-tools are used to shape metals and other materials. The material to be shaped is called the **workpiece.** Most machine-tools are now electrically driven. Machine-tools with electrical drive are faster and more accurate than hand tools: they were an important element in the development of mass production processes, as they allowed individual parts to be made in large numbers so as to be **interchangeable.**

All machine-tools have facilities for holding both the workpiece and the tool, and for accurately controlling the movement of the cutting tool relative to the workpiece. Most machining operations generate large amounts of heat, and use **cooling fluids** (usually a mixture of water and oils) for cooling and **lubrication**.

Machine-tools usually work materials mechanically but other machining methods have been developed lately. They include chemical machining, **spark erosion** to machine very hard materials to any shape by means of a continuous high-voltage spark (discharge) between an electrode and a workpiece. Other machining methods include drilling using ultrasound, and cutting by means of a **laser beam**. Numerical control of machine-tools and flexible manufacturing systems have made it possible for complete systems of machine-tools to be used flexibly for the manufacture of a range of products.

Lathe

Lathe is still the most important machine-tool. It produces parts of **circular cross-section** by turning the workpiece on its axis and cutting its surface with a sharp stationary tool. The tool may be moved **sideways** to produce a cylindrical part and moved towards the workpiece to control the depth of cut. Nowadays all lathes are power-driven by electric motors. That allows continuous rotation of the workpiece at a variety of speeds. The modern lathe is driven by means of a **headstock** supporting a **hollow spindle** on accurate **bearings** and carrying either a **chuck** or a **faceplate**, to which the workpiece is **clamped**. The movement of the tool, both along the **lathe bed** and at right angle to it, can be accurately controlled, so enabling a part to be machined to close **tolerances**. Modern lathes are often under numerical control.

ACTIVE VOCABULARY

workpiece – заготовка
interchangeable – взаємозамінний
cooling fluid – охолоджуюча рідина
lubrication – змащування
spark erosion – іскрова ерозія
laser beam – лазерний промінь
circular cross-section – круглий поперечний переріз (перетин)
to move sideway – рухати вбік
headstock – бабка токарного станка
hollow spindle – порожнистий шпиндель, вал
bearing – підшипник
chuck – патрон
faceplate – планшайба
to clamp – затискати, зажимати
lathe bed – станина токарного станка
tolerance – допустиме відхилення

TEXT STUDY

Exercise 1. Answer the questions.

1. What are machine-tools used for?
2. How are most machine-tools driven nowadays?
3. What facilities have all machine-tools?
4. How are the cutting tool and the workpiece cooled during machining?
5. What other machining methods have been developed lately?
6. What systems are used now for the manufacture of a range of products without the use of manual labor?
7. What parts can be made with lathes?
8. How can the cutting tool be moved on a lathe?
9. How is the workpiece clamped in a lathe?
10. Can we change the speeds of workpiece rotation in a lathe?
11. What is numerical control of machine tools used for?

Exercise 2. Find equivalents in the text.

1. матеріал для обробки, наданя форми
2. електропривід
3. більш точний
4. окремі деталі
5. процес масового виробництва
6. пристосування для тримання різця й деталі
7. операції з механічної обробки деталі
8. високовольтний розряд
9. свердління ультразвуком
10. різання за допомогою лазерного променя
11. гнучкі виробничі системи
12. деталі круглого перетину
13. повертати заготовку навколо її осі

14. рухати убік, рухати в напрямку до заготовки
15. глибина різання
16. безперервне обертання заготовки
17. рух різця вздовж станини

Exercise 3. Translate into English.

1. Більшість верстатів у нашій майстерні з електричним приводом.
2. Сучасні методи обробки включають хімічну обробку, іскрову ерозію, різання за допомогою лазерного променя, свердління ультразвуком.
3. Ми працюємо на верстатах, щоб надати форму металам та іншим матеріалам.
4. Відомо, що найважливіший верстат – це токарний.
5. Токарний верстат дозволяє робити деталі круглого перетину.
6. Деталь зажимається в патроні або на планшайбі токарного верстата.
7. Різець може рухатися як уздовж станини, так і під прямим кутом до неї.
8. Токарний верстат надає змогу механічно обробити заготовку з малими допусками.
9. Сучасні токарні верстати часто мають цифрове керування.
10. Заготовка – це матеріал, якому надають форму.

Text 17

Milling Machine and other Types of Machine-Tools

In a **milling machine** the **cutter** is a circular device with a series of cutting edges on its **circumference**. The workpiece is held on a table that controls the **feed** against the cutter. The table has three possible movements: longitudinal, horizontal, and vertical; in some cases it can also rotate. Milling machines are the most **versatile** of all machine tools. Flat or **contoured surfaces** may be machined with excellent **finish** and **accuracy**. Angles, **slots**, **gear teeth** and cuts can be made by using various shapes of cutters.

Drilling and Boring Machines

To drill a hole usually hole-making machine-tools are used. They can drill a hole according to some specification, they can enlarge it, or they can cut **threads** for a **screw** or to create an accurate size or a smooth finish of a hole.

Drilling machines are different in size and function, from portable drills to radial drilling machines, multispindle units, **automatic production machines**, and **deep-hole-drilling machines**.

Boring is a process that enlarges holes previously drilled, usually with a rotating **single-point cutter** held on a **boring bar** and **fed** against a stationary workpiece.

Shapers and Planers

The shaper is used mainly to produce different flat surfaces. The tool slides against the stationary workpiece and cuts on one stroke, returns to its starting position, and then cuts on the next stroke after a slight **lateral displacement**. In general, the shaper can make any surface having straight-line elements. It uses only one cutting-tool and is relatively slow, because the return stroke is **idle**. That is why the shaper is seldom found on a mass production line. It is, however, valuable for tool production and for workshops where flexibility is important and relative slowness is unimportant.

The planer is the largest of the **reciprocating machine tools**. It differs from the shaper, which moves a tool past a fixed workpiece because the planer moves the workpiece **to expose** a new section to the tool. Like the shaper, the planer is intended to produce vertical, horizontal, or diagonal cuts. It is also possible to mount several tools at one time in any or all tool holders of a planer to execute multiple simultaneous cuts.

Grinders

Grinders remove metal by a rotating **abrasive wheel**. The wheel is composed of many small grains of abrasive, bonded together, with each grain acting as a miniature cutting tool. The process gives very smooth and accurate finishes. Only a small amount of material is removed at each pass of the wheel, so grinding machines require **fine wheel regulation**. The pressure of the wheel against the workpiece is usually very light, so that grinding can be carried out on fragile materials that cannot be machined by other conventional devices.

ACTIVE VOCABULARY

milling machine – фрезерний верстат
cutter- різець
circumference – коло
feed – подача
contoured surface – контурна поверхня
finish – фінішна обробка
accuracy – точність
slot – отвір, паз, канавка
gear teeth – зуби шестерні
drilling, boring machine – свердлильний верстат
thread – різьба
screw – гвинт
automatic production machine – автоматичний виробничий верстат
deep-hole-drilling machine – верстат для глибокого свердління
single-point cutter – одноточковий різець
boring bar – розточувальний брус
to fed – подавати
shaper – поперечно-стругальний верстат

planer – рубанок
lateral displacement – бічне зміщення
idle – працювати в холосту
reciprocating machine tool – поршневий верстат
to expose – відкривати, виставляти
grinder – шліфувальний верстат, точильник
abrasive wheel – абразивний круг
fine wheel regulation – тонке регулювання колеса

TEXT STUDY

Exercise 1. Answer the questions.

1. What is the shape of a cutter in a milling machine?
2. What moves in a milling machine, a table or a cutter?
3. What possible movements has the table of a milling machine?
4. What kind of surfaces and shapes may be machined by a milling machine?
5. What can we use a drilling machine for?
6. What kinds of drilling machines exist?
7. What is rotated while boring, a cutter or a work-piece?
8. Describe the work of a shaper (planer).
9. What must be done to execute multiple simultaneous cuts on a planer?
10. What is the working tool in a grinder?
11. Can we obtain a very smooth surface after grinding and why?
12. Can we grind fragile materials and why?

Exercise 2. Guess what type of machine-tool is it.

1. Using this machine-tool we get very smooth and accurate finishes.
2. This machine-tool can drill a hole according to some specifications.
3. It is the largest of the reciprocating machine-tools, it is intended to produce vertical, horizontal or diagonal cuts.
4. Flat or contoured surfaces may be machined with this machine-tool.
5. This machine-tool is seldom found on a mass production line, it is valuable for tool production and for workshops.
6. Angles, slots, gear teeth can be made by using this machine-tool.
7. It is used to enlarge holes previously drilled.

Exercise 3. Find equivalents in the text.

Універсальний фрезерний верстат; чудова фінішна обробка і точність; різноманітні форми фрез; свердлити отвір; збільшити отвір; нарізати різьбу для гвинта; виробництво інструментів; нерухома (стаціонарна) заготовка; виконувати кілька одночасних розрізів; видаляти метал; крихкі матеріали; піддаватися механічній обробці звичайними пристроями.

Text 18

Couplings and Clutches

Couplings and **clutches** are intended to connect **shafts** or other **revolving parts** and in modern mechanical engineering they form **integral components** of almost all machines. Couplings and clutches link together the shafts of turbines and generators, prime movers and **driving mechanisms**, as well as the shafts of separate units and assemblies effect smooth or **instantaneous** starting stopping, reversing and **gear change** of machines; protect against overload and **racing** and prevent reverse rotation.

Clutches are employed to connect and disconnect shafts during their relative motion (under load) or at **standstill**. According to the forces which keep them engaged, clutches may be divided into four groups: **friction**, **claw (toothed) electromagnetic fluid**, and **electromagnetic powder**, and hydraulic clutches. Depending on the manner in which clutches are operated they are subdivided into those controlled by an operator directly or by means of auxiliary force, and **power controlled clutches**.

ACTIVE VOCABULARY

coupling (clutch) – муфта зчеплення, з'єднання
shaft – вал
revolving part – обертова частина
integral component – невід'ємний компонент
driving mechanism – приводний механізм
instantaneous – миттєвий
gear change – перемикання передач
racing – перегони
standstill – зупинка
friction clutch – фрикційне зчеплення
claw (toothed) clutch – зубчаста муфта
electromagnetic fluid clutch– електромагнітна рідинна муфта
electromagnetic powder clutch – електромагнітні порошкові муфти
power controlled clutches – муфта зчеплення з регулюванням потужності

TEXT STUDY

Exercise 1. Answer the questions.

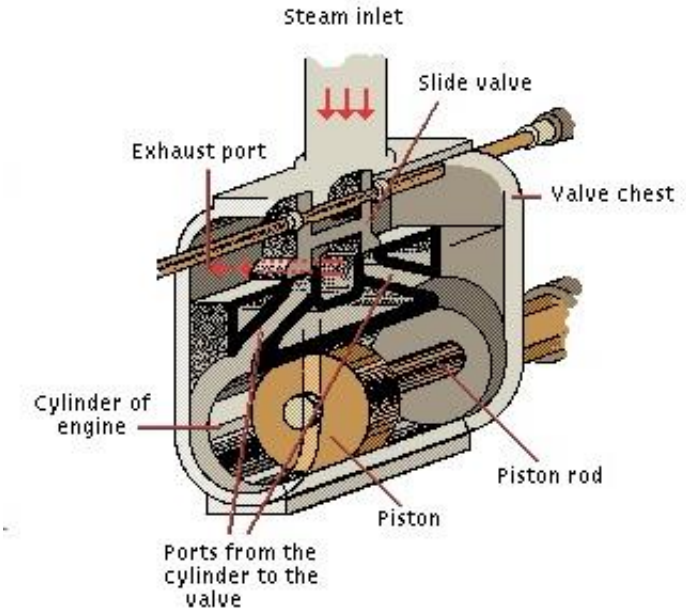
1. What couplings and clutches intended to do?
2. What do they link?
3. Couplings and clutches protect against overload and racing and prevent reverse rotation, don't they?
4. Name four groups of clutches according to the forces which keep them engaged.
5. Name groups of clutches depending on the manner in which they are operated.

Exercise 2. Find equivalents in the text.

1. з'єднувати вали та обертові частини
2. вал турбіни чи генератора
3. забезпечити плавне або миттєве зупинення пуску

4. захищати від перевантажень
5. запобігати зворотньому обертанню
6. використовуватись для з’єднання та роз’єднання валів
7. сучасне машинобудування

Text 19



Steam Engine

Steam engine is any engine that is operated by the energy of expanding steam. The steam may be used **to power an engine** by spinning a turbine or by pushing **pistons**. Huge turbines drive electric generators and giant ships. Piston steam engines power large **pile drivers**. In some countries, locomotives with piston steam engines are still used to pull railroad trains. In the United States, diesel locomotives pull most trains.

The development of the steam engine in the 1700's made modern industry possible. Until then, people had to depend on the power of their own muscles or on animal, wind, and water power. One steam engine could do the work of many horses. It could supply the power needed to run all the machines in a factory.

A steam locomotive could **haul** heavy loads of great distances in a single day. Steamships provided safe, fast, **dependable** water transportation.

How Steam Engines Work

A steam engine uses steam to change heat energy into rotary or **reciprocating (back-and-forth) motion**. Most steam engines have a **furnace** in which coal, oil, or some other fuel is burned to produce heat energy. In atomic power plants, a nuclear reactor supplies the heat energy.

Every steam engine has a **boiler**. The heat energy produced inside the furnace or reactor changes water into steam inside the boiler. The steam expands, taking up many times the space of the original water. This energy of expansion can be used in two ways: (1) to spin a turbine, or (2) to push a piston back and forth.

Steam turbines produce a rotary motion. A steam turbine has many sets of **bladed wheels mounted** on a long shaft. The steam enters at one end and spins the bladed wheels as it rushes past them. Steam turbines, which are more efficient than reciprocating steam engines, are used to turn electric generators and **ship propellers**.

Reciprocating steam engines have pistons that slide back and forth in cylinders. Various **valves** allow the steam to enter a cylinder and drive a piston first in one direction and then the other before they **exhaust** the used steam. Steam hammers that drive piles and forge metal require reciprocating motion. A locomotive, however, requires rotary motion to turn its wheels. This motion is achieved by attaching a **crankshaft** to the pistons. In some reciprocating steam engines, called **compound engines**, the steam may flow through two, three, or four cylinders and operate the same number of pistons.

ACTIVE VOCABULARY

to power an engine – приводити в дію двигун (живити двигун)
piston – поршень
pile driver – забійна машина
to haul – перевозити, буксирувати
dependable – надійний
reciprocating (back-and-forth) motion – зворотно-поступальний (вперед-назад) рух
furnace – піч, топка
boiler – котел
bladed wheel – колесо з лопатями
to mount – монтувати, встановлювати
ship propeller – корабельний гвинт
valve – клапан
to exhaust - випускати
crankshaft – колінчастий вал.
compound engine – складний двигун

TEXT STUDY

Exercise 2. Find equivalents in the text.

Використовуватись для живлення двигуна, керувати кораблем, тягнути потяг, подавати живлення, перевозити великий вантаж, теплова енергія, спалювати паливо в топці, крутити турбіну, рухати поршень вперед-назад, обертальний рух, вал турбіни, випускати використану пару, кувати метал, клапан та колінвал двигуна.

Exercise 1. Read the text and find the expressions, which mean:

a) hot mist that water produces when it is boiled;
b) an engine or motor in which the pressure of a liquid or gas moves a special wheel around;
c) a space that is completely empty of all gas, especially one from which all the air has been taken away;
d) warmth or the quality of being hot;

e) a part of an engine consisting of a short solid piece of metal inside a tube which moves up and down to make the other parts of the engine move.

Exercise 2. Match the words in column A with the words in column B to form meaningful phrases. Translate them into Ukrainian.

Column A	*Column B*
1) high	a) energy
2) reciprocating	b) load
3) partial	c) generator
4) nuclear	d) sides
5) heat	e) pressure
6) heavy	f) engine
7) electric	g) reactor
8) surrounding	h) vessel
9) opposite	i) vacuum
10) bladed	j) motion
11) steam	k) atmosphere
12) sealed	l) wheels

Exercise 3. Fill in the words from the list below and use them in your own sentences. Use each word only once.

action, atomic, reciprocating, hollow, energy, partial, liquid, steam, engines electric, regions, act

1) to require ….. motion
2) energy of expanding …..
3) to ….. together to perform work
4) reciprocating steam …..
5) small ….. globe
6) ….. of high pressure
7) to produce heat …..
8) to drive ….. generators
9) to condense back into a …..
10) ….. power plant
11) to create a ….. vacuum
12) to exert a sucking …..

Exercise 4. Match the English words with their Ukrainian equivalents.

Main parts of the steam engine:

1) turbine	a) поршень
2) piston	b) вал
3) generator	c) колесо
4) furnace	d) топка
5) boiler	e) колінчастий вал
6) shaft	f) клапан
7) blade	g) контейнер
8) wheel	h) циліндр

9) valve	i) генератор
10) crankshaft	j) бойлер
11) cylinder	k) турбіна
12) vessel	l) лопать

Exercise 5. Arrange the words according to similar meaning.

1) engine	a) movement
2) container	b) method
3) liquid	c) apparatus
4) way	d) reservoir
5) energy	e) spread
6) device	f) task
7) motion	g) mechanism
8) expansion	h) power
9) pipe	i) operation
10) machine	j) fluid
11) work	k) motor
12) action	l) tube

Exercise 6. Find the definitions to the following words.

shaft, cylinder, device, pipe, liquid, gas, pressure, motion, transportation, load, energy, engine

1. The act, way or process of moving.
2. A substance which is not a solid or a gas, which flows, is wet and has no fixed shape.
3. The action of putting force or weight onto something; the strength of this force.
4. The tube within which a piston moves backwards and forwards in an engine or piece of machinery.
5. A piece of machinery with moving parts which changes power from steam, electricity, oil, etc., into movement.
6. The amount of work that must be done by a machine.
7. A piece of equipment intended for a particular purpose.
8. A type of substance like air, which is not solid or liquid and usually cannot be seen.
9. The power, which can do work, such as drive machines or provide heat.
10. A tube used for carrying liquids or gas, often underground.
11. A bar which turns, or around which a belt or wheel turns, to pass on power or movement from an engine to something driven by the engine.
12. The act of transporting or state of being transported.

Exercise 7. Choose the correct answer.

1. What new source of power helped to drive the Industrial Revolution?

a. Water
b. Steam
c. Wind
d. Horse
e. Nuclear

2. What was the drawback of using a river as power for a factory?

a. Unreliable
b. The factory had to be near a river
c. Rivers could freeze
d. Rivers could dry up
e. All of the above

3. What do steam engines boil to create steam for power?

a. Water
b. Gasoline
c. Oil
d. All of the above
e. None of the above

4. What was an advantage of steam power?

a. It was free
b. Factories could be located anywhere
c. It used the wind
d. All of the above
e. None of the above

5. True or False: Steam power was used in a number of different applications?

a. TRUE
b. FALSE

6. What term did James Watt use to describe how much power a steam engine could produce?

a. Watt
b. Ampere
c. Horsepower
d. Manpower
e. Joule

7. Which of the following was a practical use for steam engines?

a. Factories
b. Mines
c. Locomotives
d. Steamboats
e. All of the above

8. True or False: Steam power is used today in both electricity and nuclear power plants.

a. TRUE
b. FALSE.

9. Why didn't the Greeks use steam engines?

a. due to poverty
b. due to poor materials
c. due to slavery
d. due to laziness

10. What does steam create within this vessel?

a. partial vacuum
b. pressure
c. heat
d. condensate

Text 20

Internal Combustion Engine

1. While the steam engine remained dominant in industry and transportation during much of the 19th century, engineers and scientists began developing other sources and converters of energy. One of the most important of these was the internal combustion engine. In such a device a fuel and **oxidizer** are burned within the engine and the products of combustion act directly on piston or rotor surfaces.

2. Four principal types of internal combustion engines are in general use: the Otto-cycle engine, the diesel engine, the rotary engine, and the gas turbine engine. The Otto-cycle engine, named after its inventor, the German technician Nikolaus August Otto, is the familiar **gasoline engine** used in automobiles and airplanes; the diesel engine, named after the French-born German engineer Rudolf Christian Karl Diesel, operates on a different principle and usually uses **oil** as a fuel. It is employed in electric-generating and **marine-power plants**, in trucks and buses, and in some automobiles. Both Otto-cycle and diesel engines are manufactured in two-stroke and four-stroke cycle models.

3. The essential parts of Otto-cycle and diesel engines are the same. The **combustion chamber** consists of a cylinder, usually fixed, that is closed at one end and in which a **close-fitting piston** slides. The **in-and-out motion** of the piston varies the volume of the chamber between the inner face of the piston and the closed end of the cylinder. The outer face of the piston is attached to a crankshaft by a **connecting rod**. The crankshaft transforms the reciprocating motion of the piston into rotary motion. In multicylindered engines the crankshaft has one **offset portion**, called a **crankpin**, for each connecting rod, so that the power from each cylinder is applied to the crankshaft at the appropriate point in its rotation. Crankshafts have heavy **flywheels** and **counterweights**, which by their inertia minimize irregularity in the motion of the shaft. An engine may have from 1 to as many as 28 cylinders.

4. The fuel supply system of an internal-combustion engine consists of a **tank**, a fuel pump, and a device for **vaporizing** or **atomizing** the liquid fuel. In Otto-cycle engines this device is either a carburetor or, more recently, a **fuel-injection system**. In most engines with a carburetor, vaporized fuel is conveyed to the cylinders through a **branched pipe** called the **intake manifold** and, in many engines, a similar exhaust manifold is provided to carry off the gases produced by combustion. The fuel is admitted to each cylinder and the **waste gases** exhausted through mechanically operated **poppet valves** or **sleeve valves**. The valves are normally held closed by the pressure of **springs** and are opened at the proper time during the **operating cycle** by **cams** on a rotating **camshaft** that is **geared** to the

crankshaft. By the 1980s more sophisticated fuel-injection systems, also used in diesel engines, had largely replaced this traditional method of supplying the proper mix of air and fuel. In engines with fuel injection, a mechanically or electronically controlled monitoring system injects the appropriate amount of gas directly into the cylinder or inlet valve at the appropriate time. The gas vaporizes as it enters the cylinder. This system is more fuel efficient than the carburetor and produces less pollution.

5. In all engines some means of igniting the fuel in the cylinder must be provided. For example, the ignition system of Otto-cycle engines consists of a source of low-voltage, direct-current electricity that is connected to the **primary** of a transformer called an **ignition coil**. The current is interrupted many times a second by an automatic switch called the timer. The pulsations of the current in the primary **induce a pulsating**, high-voltage current in the secondary. The high-voltage current is led to each cylinder in turn by a rotary switch called the distributor. The actual ignition device is the **spark plug**, an **insulated conductor set** in the wall or top of each cylinder. At the inner end of the spark plug is a small gap between two wires. The high-voltage current **arcs** across this gap, **yielding** the spark that ignites the fuel mixture in the cylinder.

ACTIVE VOCABULARY

oxidizer – окислювач
gasoline engine – бензиновий двигун
oil – масло
marine-power plant – морська електростанція
combustion chamber – камера згоряння
close-fitting piston – щільно прилягаючий поршень
in-and-out motion – рух всередину і назовні
connecting rod – шатун, з'єднувальна тяга
offset portion – зміщена частина
crankpin – шатун
counterweight – противага
tank- бак
vaporizing – випаровування
atomizing – розпилення
fuel-injection system – система вприскування палива
branched pipe – розгалужена труба
intake manifold – впускний колектор
waste gas – відпрацьований газ
poppet valve – тарілчастий клапан
sleeve valve – рукавний клапан
spring – ресора
operating cycle – робочий цикл
cam – кулачок
camshaft – розподільчий вал
to be geared – бути приєднаним
primary – первинна обмотка

ignition coil – котушка запалювання
to induce a pulsating – викликати пульсацію
spark plug – свічка запалювання
insulated conductor set – набір ізольованих провідників
to arc across – проходити через
to yield the spark – виробляти, утворювати іскру

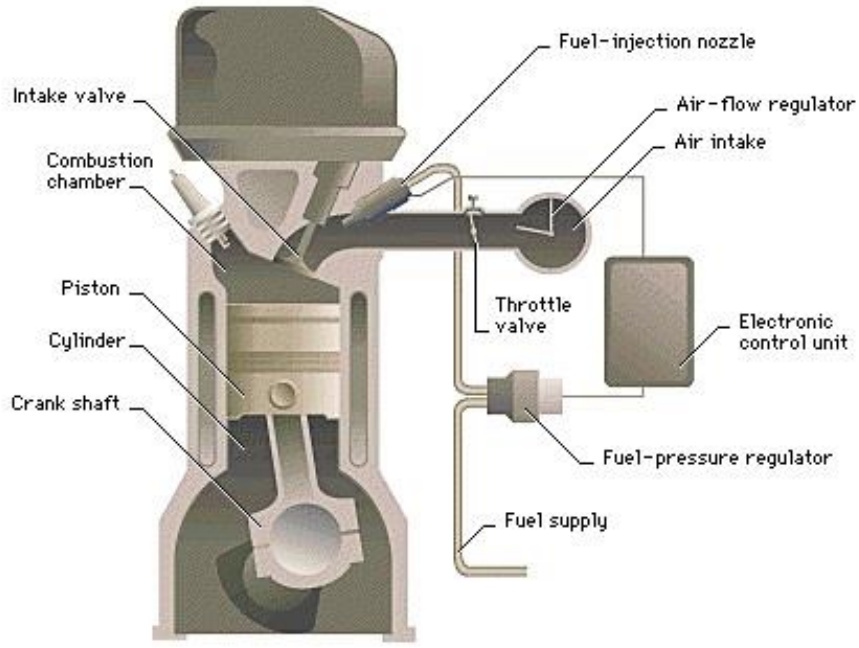
TEXT STUDY

Exercise 1. Read the text and match the questions (a-e) to the paragraphs (1-5).

1. What parts do Otto-cycle and diesel engines consist of?
2. Where are the different types of internal-combustion engines used?
3. What are the main parts of the ignition system of Otto-cycle engines?
4. Where are fuel and oxidizer burned in an internal-combustion engine?
5. How is fuel supplied in an internal-combustion engine?

Exercise 2. Look at the diagram and try to explain how the internal-combustion engine works. Use the words and phrases below.

fuel-injection system, carburetor, vehicle, to provide, fuel delivery system, electronic sensors, engine speeds, the ratio of fuel to air, fuel-injection nozzle, combustion chamber, mixture of fuel and air, to trigger ignition



Exercise 3. Match the words in column A with the words in column B to form meaningful phrases. Translate them into Ukrainian.

Column A	*Column B*
1) diesel	a) rod
2) combustion	b) surface
3) gas	c) motion
4) rotor	d) flywheel
5) connecting	e) pump
6) reciprocating	f) gas

7) four-stroke	g) engine
8) heavy	h) camshaft
9) fuel	i) valve
10) rotating	j) cycle
11) waste	k) turbine
12) sleeve	l) chamber

Exercise 4. Match the English words and phrases with their Ukrainian equivalents.

Main parts of the internal combustion engine

1) crankshaft	a) камера згоряння
2) piston	b) впускний клапан
3) fuel pump	c) бак
4) inlet valve	d) карбюратор
5) combustion chamber	e) поршень
6) counterweight	f) циліндр
7) connecting rod	g) паливний насос
8) flywheel	h) вал
9) cylinder	i) противага
10) carburetor	j) колінчастий вал
11) shaft	k) маховик
12) tank	l) з'єднувальна тяга

Exercise 5. Arrange the words according to similar meaning.

1) combustion	a) tubing
2) supply	b) capacity
3) chamber	c) counterbalance
4) tank	d) delivery
5) volume	e) contamination
6) pollution	f) fuse
7) ignition	g) burning
8) mixture	h) turning
9) rotation	i) cell
10) waste	j) container
11) manifold	k) blend
12) counterweight	l) garbage

Exercise 6. Match the English phrases with their Ukrainian equivalents.

Types of engines

1) four-stroke engine	a) прогрітий двигун
2) heavy-duty engine	b) дизельний двигун
3) warmed-up engine	c) двигун, який заглох
4) gas-turbine engine	d) лебідка
5) dead engine	e) газовий двигун
6) high-efficiency engine	f) двигун на твердо-рідкому паливі
7) oil engine	g) серійний двигун
8) gas engine	h) чотирьох тактний двигун
9) stock engine	i) газотурбінний двигун

10) solar engine j) двигун з високим ККД
11) gasoline engine k) бензиновий двигун
12) monkey engine l) сонячний двигун

Exercise 7. Fill in the words from the list below and use them in your own sentences. Use each word only once.

mechanically, engine, plants, fuel, current, stroke, ignition, voltage, piston, system, gasoline, supplying

1) direct-….. electricity
2) fuel supply …..
3) high-….. current
4) actual ….. device
5) internal-combustion …..
6) …..-injection system
7) four-….. cycle model
8) familiar ….. engine
9) close-fitting …..
10) traditional ….. method
11) marine-power …..
12) ….. operated poppet valves

Exercise 8. Find the definitions to the following words.

crankshaft, camshaft, piston, fuel, air, spring, tank, combustion, cam, rotor, rotation, switch

1. A part of an engine consisting of a short solid pipe-shaped piece of metal that fits tightly into a cylinder, it is moved up/down by means of pressure.
2. A place where liquid is stored.
3. The chemical activity, usually in the presence of oxygen, that produces light and heat.
4. An apparatus for stopping or starting the flow of an electric current, especially one which is moved up or down with the hand.
5. The action of rotating; one complete turn round a fixed point.
6. The mixture of gases which surrounds the earth and which we breathe.
7. A wheel or part of a wheel shaped to change circular movement into backwards and forwards movement.
8. A part of a machine that turns round on a fixed point.
9. A rod to which a cam is fastened.
10. A length of metal wound round, which can be forced together or pressed down, and will return to its original shape when let go.
11. A rod that turns or is driven by a crank in a car engine.
12. Material that is used for producing heat or power by burning or by atomic means.

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