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**АНГЛІЙСЬКА МОВА ДЛЯ ІНЖЕНЕРІВ-МЕХАНІКІВ**



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Посібник призначений для розвитку практичних умінь та навичок іншомовного спілкування та розуміння фахово спрямованої літератури іноземною мовою. Рекомендується використання посібника для підготовки студентів зі спеціальності «Прикладна механіка». Посібник містить навчальний матеріал, що відповідає програмі курсу англійської мови, яка вивчається у технічних ВНЗ. Завданням рукопису є забезпечення знань, необхідних фахівцям для роботи у галузі механічної інженерії.

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**PART 1**  
**UNIT 1**  
**ENGINEERING**

***Ex. 1. Read and translate the text***

Engineering can be defined as the creative application of scientific principles to design or develop structures, machines, apparatus or manufacturing processes.

Engineering is based principally on physics, chemistry and mathematics, and their extensions into materials science, solid and fluid mechanics, thermodynamics, transfer and rate processes, and systems analysis.

One who practices engineering is called an engineer. Engineers figure out how things work and find practical uses for scientific discoveries.

Engineering as a profession involves different tasks. It can refer specifically to the manufacture or assembly of engines, machine tools and machine parts. It is also used more generally to construct and forecast the behaviour of structures, machines, manufacturing processes and works. Engineers design, evaluate, develop, test, modify, install, inspect and maintain a wide variety of products and systems. They also recommend and specify materials and processes, supervise manufacturing and construction, conduct failure analysis, provide consulting services and teach engineering courses in colleges and universities. The function of scientists is to know, while the one of engineers is to do: they must solve specific problems.

Different branches of engineering require different equipment and are based on different processes.

*Branches of engineering:* chemical, civil, electrical, electronic, hydraulic, industrial, mechanical, mining, petroleum production, structural.

*Equipment in engineering:* boiler, crane, gas engine, machine tool, pump, turbine.

*Processes in treating metals:* anneal, anodize, electroplate, forge, found, galvanize, grind, harden, mint, plate, roll, soften, temper, tinsplate.

***Active Vocabulary***

anneal [ə'ni:l] – випалювати, обпалювати

anodize ['ænə(u)daɪz] – піддавати анодній обробці

apparatus [æpə'reɪtəs] – прилад, інструмент, апарат, апаратура, машина, механізм

application – застосунок

assembly of engines – комплектування двигунів

boiler – паровий котел

crane – вантажопідіймальний кран

electroplate – гальванокліше, покривати металом за допомогою електролізу

extension – поширення  
fluid mechanics – механіка рідин, газів, гідроаеромеханіка  
forge – кузня, ковальське горно  
galvanize – оцинковувати, електризувати  
grind – шліфувати, полірувати, точити, гострити  
hydraulic [hai'drɒlik] – гідравлічний, гідротехнічний  
involve – включати, містити  
modify – видозмінювати  
plate – обшивати металевим листом, накладати срібло, золото  
rate process – обчислювальний процес  
temper – зменшувати, пом'якшувати, змішувати в потрібних пропорціях

**Ex. 2. Complete the following sentences with a correct form of the word in brackets**

1. In the \_\_\_\_\_ (metallurgy) industry, \_\_\_\_\_ (an engineer) develop processes for producing plastics, fibres, medicines, etc. from simple \_\_\_\_\_. (chemistry)
2. Producing steel using the Bessemer process is one of the best-known \_\_\_\_\_ processes. (industry)
3. Most \_\_\_\_\_ (mechanics) devices need oil as a lubricant.
4. Following the earthquake, every building had to be inspected to see whether it had suffered any \_\_\_\_\_ (structure) damage.
5. Certain chemicals are added to glue to \_\_\_\_\_ (hard) it.
6. Excavators and power shovels are two types of \_\_\_\_\_ (to construct) equipment used by \_\_\_\_\_ (mine) when they are removing roles from the ground.

**Ex. 3. Listen to the information about typical activities of a mechanical engineer and speak about advantages and disadvantages of this profession**

As I am going to find a job of a mechanical engineer, I expect dealing with the following typical activities:

- designing and implementing cost-effective equipment modifications to help improve safety, reliability and throughput;
- developing a project specification with colleagues, often including those from other engineering disciplines;
- developing, testing and evaluating theoretical designs;
- discussing and solving complex problems with manufacturing departments, sub-contractors, suppliers and customers;
- making sure a product can be made again reliably and will perform consistently in specified operating environments;
- managing projects using engineering principles and techniques;
- planning and designing new production processes;
- producing details of specifications and outline designs;
- recommending modifications following prototype test results;

using research, analytical, conceptual and planning skills, particularly mathematical modelling and computer-aided design;

considering the implications of issues such as cost, safety and time constraints;

working with other professionals, within and outside the engineering sector; monitoring and commissioning plant and systems.

***Ex. 4. Match the following verbs with the correct definition***

anneal	to melt metal and then pour it into a form, e.g. iron components
anodize	to make thin sheets of metal by passing it between large rollers, e.g. steel
electroplate	to shape metals by heating and then hammering, e.g. horse shoes
forge	to make materials tough by cooling them slowly, e.g. glass
found	to make something softer, e.g. fibres
galvanize	to heat and then cool metals to obtain the required hardness and elasticity, e.g. steel
grind	to cover with a thin layer of metal using electrolysis, e.g. car components
roll	to protect from rusting by coating in zinc, e.g. food cans
plate	to give a metal a protective coat by using it as an anode in electrolysis, e.g. car components
soften	to polish or sharpen by rubbing on a rough surface, e.g. stone
temper	to cover one metal with a thin layer of another, e.g. silver plate

***Ex. 5. Translate the following sentences into English***

1. Сучасна інженерна діяльність спрямована на вирішення технічних завдань і створення техніки.

2. Третій етап становлення інженерії відбувався в епоху промислового перевороту і поширення робочих машин на базі парового двигуна.

3. Особливість інженерії полягає в тому, що вона спрямована на розв'язання суперечностей між природою і суспільством.

4. В умовах розвиненої технічної науки будь-який винахід ґрунтується на ретельних інженерних дослідженнях.

5. В інженерії широко використовуються технічні випробування та аналіз перед запровадженням технічних вирішень, з тим щоб оцінити їхню

працездатність.

6. Комп'ютери є важливим інструментом сучасної інженерії.

7. Вони підтримують діяльність інженерів на кожному етапі роботи: від проектування до виробництва та керування обладнанням.

8. Орієнтація сучасного інженера тільки на природничі та технічні науки і математику не завжди відповідає його справжньому місцю в науково-технічному розвитку сучасного суспільства.

***Ex. 6. Make up a short presentation about one of the branches of engineering, or equipment in engineering, or processes in treating metals***



## UNIT 2

### A JOB IN ENGINEERING

#### ***Ex. 1. Read and translate the text***

Engineering is an important sphere of technical progress in the modern world. There are lots of different types of engineering. The one thing they have in common is that they all use mathematics and science to improve industry and manufacturing. The whole science of engineering can be divided into a large number of areas. The main of them are:

*Mechanical engineering* involves design, manufacturing, inspection and maintenance of machinery, equipment and components as well as control systems and instruments for monitoring their status and performance. This includes vehicles, construction and farm machinery, industrial installations and a wide variety of tools and devices.

*Civil engineering* involves design, construction, maintenance and inspection of large infrastructure projects such as highways, railroads, bridges, tunnels, dams and airports.

*Electrical engineering* involves design, testing, manufacturing, construction, control, monitoring and inspection of electrical and electronic devices, machinery and systems. These systems vary in scale from microscopic circuits to national power generation and transmission systems.

*Biomedical engineering* involves designing systems, equipment and devices for use in the practice of medicine. It also involves working closely with medical practitioners, including doctors, nurses, technicians, therapists and researchers, in order to determine, understand and meet their requirements for systems, equipment and devices.

*Aerospace engineering* involves design, manufacturing and testing of aircraft and spacecraft as well as parts and components such as airframes, power plants, control and guidance systems, electrical and electronic systems, and communication and navigation systems.

Clearly there is a big difference between building a road and designing a computer system so the best advice for students is:

- think carefully about which area of engineering interests you most. It is difficult to study if you are not interested – and you may do the job until you are 60 years old;

- think about what sort of person you are:

will you be happiest working in an office, in a factory, or outdoors?

do you mind getting dirty?

do you want to work with other people or alone? If you like wearing high heels and beautiful clothes, you may not be happy on a building site.

When you have decided which area you are interested in and thought realis-

tically about what sort of person you are, then you can decide what sort of engineer you want to be.

### ***Active Vocabulary***

airframe – корпус літального апарата  
circuit – схема, мережа  
civil engineering – громадянське будівництво  
dam – дамба, гребля,  
highway ['haiwei] – автомагістраль, автострада  
maintenance ['meint(ə)nəns] – догляд, ремонт (поточний), технічне обслуговування, матеріально-технічне забезпечення  
practitioner [præk'tiʃ(ə)nə] – практикуючий лікар  
railroad – залізниця  
vary [veəri] – варіювати, змінювати  
vehicles – автотранспорт

### ***Ex. 2. Put the main ideas (A-D) in the same order as they are in the text***

- A. You need to think carefully about your personality.
- B. There are lots of different jobs in engineering.
- C. Think carefully about what you are interested in.
- D. Engineering is a big subject.

### ***Ex. 3. Read the text again. Choose the correct words in italics to complete the sentences below***

- 1. Engineering *is/isn't* a small area.
- 2. Engineering *is/isn't* about Science and Maths.
- 3. Office buildings and bridges *are/aren't* examples of civil engineering.
- 4. Tool- and machine-making *are/aren't* examples of electrical engineering.

### ***Ex. 4. Look at the types of engineers below. Then write whether the jobs are indoor or outdoor, and dirty or clean***

- 1. petroleum
- 2. sanitation
- 3. textile
- 4. computer
- 5. chemical

### ***Ex. 5. Read the following statements about the things making students successful in their studies***

Successful students exhibit a combination of successful attitudes and behaviors as well as intellectual capacity. Successful students:

- are responsible and active;
- have educational goals;
- ask questions;

learn that a student and a professor make a team;  
don't sit in the back;  
take good notes;  
understand that actions affect learning;  
talk about what they're learning;  
don't cram for exams.

***Ex. 6. Write your name and the type of engineer you want to be on a small piece of paper. Put your paper in a box and take out another student's paper. Write three questions to check if that person is choosing the right type of engineering***

*Example: Mining engineer*

- Do you like working indoors or outdoors?
- Do you mind getting dirty?
- Do you like going underground?

***Ex. 7. Some of the best interview questions asked for a mechanical engineering student***

1. Tell me something about yourself and your family background.
2. Give us an overview of your summer internship. What was its practical application?
3. Tell me your area of interest.
4. Draw the P-V and T-S diagram of otto cycle.
5. What made you choose to work at this company?
6. What challenges are you experiencing right now? What keeps you up at night?
7. What concerns do you have with us working together?
8. What are your next steps to move forward?
9. Why should we not hire you?
10. How would you describe a dynamometer to an 8-year-old child?

***Ex. 8. Listen to the information about typical activities of a maintenance engineer and speak about advantages and disadvantages of this profession***

As I am going to find a job of a maintenance engineer, I expect dealing with the following typical activities:

designing maintenance strategies, procedures and methods;  
planning and scheduling planned and unplanned work;  
diagnosing breakdown problems;  
carrying out quality inspections on jobs;  
liaising with client departments and customers;  
arranging specialist procurement of fixtures, fittings or components;  
controlling maintenance tools, stores and equipment;  
monitoring and controlling maintenance costs;  
dealing with emergency and unplanned problems and repairs;

writing maintenance strategies to help with installation and commissioning guidelines.

***Ex. 9. Translate the following sentences into English***

1. Інженер-механік працює на промисловому підприємстві конструктором, технологом, інженером виробництва.

2. Інженер-механік має знати природні й точні науки, основи інженерної діяльності, історію розвитку виробів, інфотехнології.

3. Він має розумітись в елементах машин, техніці, аеро- і гідродинаміці, машинній механіці та комп'ютерному проектуванні.

4. Також потрібно знати більш вузькі механічну й технічну області конструювання, машинобудування, зварювання, мехатроніки та економічну діяльність.

5. Щоб працювати в цій сфері треба мати, технічну кмітливість і творче ставлення до роботи, потрібно бути точним, відповідальним, вміти працювати в команді.

6. Інженер-механік має вміти користуватися захисними засобами – рукавичками, маскою, допоміжним робочим інструментом.

7. Гарний фахівець – інженер-механік – вільно орієнтується в сучасній техніці і технології, винахідливо використовує інженерні методи у вирішенні завдань механіки, знає економіку і організацію виробництва тієї галузі, в якій працює.

8. Діяльність інженера-механіка залежить від місця його роботи.

9. Професія інженера-механіка широко затребувана в сучасному високотехнологічному світі.

10. Професію інженера-механіка можна отримати в багатьох технічних університетах.

11. Заробітна плата інженера-механіка залежить від його кваліфікації, досвіду роботи і сфери діяльності.

12. Створення механічних апаратів або машин є дуже складним процесом.

***Ex. 10. Make up a short presentation about any job in engineering***

## UNIT 3 AUTOMATION

### *Ex. 1. Read and translate the text*

Mechanization was the first step necessary in the development of automation. The simplification of work made it possible to design and build machines that resembled the motions of the worker. These specialized machines were motorized and they had better production efficiency.

So, mechanization refers to the process of providing human beings with machinery capable of assisting them with the muscular requirements of work. A further development of mechanization is represented by automation, which implies the use of control systems and information technologies to reduce the need for both physical and mental work to produce goods. It also can be defined as the creation and application of technology to monitor and control the production and delivery of products and services.

Over the last centuries automation has had a great impact on industries, changing the world economy from industrial jobs to service jobs. In manufacturing, where the process began, automation meant that the desired results could be obtained through a series of instructions made automatically by the system, which defined the actions to be done. Automated manufacturing improves work flow and increases the morale of workers when a good implementation of the automation is made. It also provides benefits to virtually all of industry. Here are some examples:

- manufacturing, including food and pharmaceutical, chemical and petroleum, pulp and paper;
- transportation, including automotive, aerospace and rail;
- utilities, including water and wastewater, oil and gas, electric power and telecommunications;
- defense;
- facility operations, including security, environmental control, energy management, safety, and other building automation.

However, the purpose of automation cannot be seen only in terms of a reduction of cost and time; there are several more aspects to be taken into consideration. For example, while it is true that automation offers a higher precision in the manufacturing process, it is also true that it requires skilled workers who can make repairs and manage the machinery.

### *Active Vocabulary*

implementation – здійснення, виконання

imply – означати

machinery – механізми, машини, обладнання

mental – розумовий

muscular ['meskjule] – м'язовий, мускульний, сильний

obtain – одержувати, отримувати  
 pharmaceutical [fə:mə'sju:tik(ə)l] – фармацевтична продукція  
 precision [pri'siʒ(ə)n] – точність  
 pulp [peɪp] – перетворювати на м'яку масу  
 reduce – знижувати, зменшувати  
 repair – ремонт  
 resemble [ri'zemb(ə)l] – бути схожим, мати подібність  
 virtually ['vɜ:tʃʊəli] – фактично, практично, у дійсності, реально

**Ex. 2. Answer the following questions**

1. What is automation?
2. Why is the term “automation” used?
3. What industries use automation technologies?
4. What is the most “familiar example” of automation?
5. What benefits does automation provide to virtually all of industry?
6. What does manufacturing consist of?
7. What was the first step in the development of automation?
8. What do we mean speaking about facility operations?
9. Why are skilled workers required?

**Ex. 3. Match the words with their definitions**

1. Manufacturing	a) the time between the design of a product and its production
2. Information technologies	b) the amount of confidence that a group of people have
3. Goods	c) a set of tasks performed to complete a procedure
4. Service jobs	d) the process of packing and distributing goods
5. Skilled	e) the industry in which machinery is used to produce goods
6. Morale	f) the development and application of computer systems
7. Unemployment	g) having the knowledge and the ability to do something well
8. Lead times	h) things that are made to be sold
9. Handling	i) jobs in transports, communications, hospitals, energy industry, etc.
10. Work flow	j) the state of not having a job

***Ex. 4. Make up the table that sums up the main advantages and disadvantages of automation***

1. Speeding up the developmental process of society.
2. Disastrous effects on the environment (pollution, traffic, energy consumption).
3. Technical limitations as current technology is unable to automate all the desired tasks.
4. Sharp increase in unemployment rate due to machines.
5. Saving time and money as human operators can be employed in higher-level work automate all the desired tasks.
6. Replacing human operators in tasks that involve hard physical or monotonous work replacing human beings.
7. Replacing human operators in tasks done in dangerous environments (fire, space, volcanoes, nuclear facilities, underwater).
8. Security threats as an automated system may have a limited level of intelligence and can make errors.
9. Unpredictable costs due to research and development, which may exceed the cost saved by the automation itself.
10. Higher reliability and precision in performing tasks.
11. Economy improvement and higher productivity.
12. High initial costs as the automation of a new product requires a large initial investment.

***Ex. 5. Translate the following sentences into English***

1. Мета автоматизації – це підвищення продуктивності праці, поліпшення якості продукції, оптимізація управління, усунення людини від виробництв, небезпечних для здоров'я.
2. Система автоматизації означає сукупність програмованих пристроїв автоматизованого та автоматичного контролю, регулювання та управління.
3. Автоматизація є актуальною в наступних галузях: виробництво сталі, гірнична справа, машинобудування, хімічне виробництво, харчова промисловість, енергетика, керування автомобільним, залізничним і повітряним транспортом.
4. Часткова автоматизація передбачає автоматизацію основних виробничих процесів.
5. Комплексна автоматизація передбачає автоматизацію не тільки процесу виробництва, але й процесів керування й обслуговування.

6. Повна автоматизація передбачає автоматизацію всіх основних і допоміжних процесів.

7. Сукупності функцій в автоматизованих виробничих системах утворюють системні комплекси.

8. В Україні автоматизація виробництва особливо активно почала розвиватися з другої половини 1950-х років.

9. Слово «автоматизація» походить від грецького слова «автомат», що означало механізми, які діяли самостійно, без втручання людини.

10. Механізація виробничих процесів полегшує фізичну, а автоматизація – розумову працю людини.

11. На початку роботи пуск електродвигуна автоматизований, але після запуску процес відбувається за допомогою ручного керування.

12. Автомат – це пристрій, який виконує певну послідовність операцій у режимі автоматичного управління.

***Ex. 6. Make up a short presentation about the role of automation at Ukrainian enterprises***



## UNIT 4 INDUSTRIAL REVOLUTIONS

### *Ex. 1. Read and translate the text*

As the history of human progress has been one of technological development, engineering has been around as a concept for a long time. Engineering began to be recognized as a distinct profession in the 18th century. The history of mechanical engineering goes back to the time when the man first tried to make machines. We can call the earlier rollers, levers and pulleys, for example, the work of mechanical engineering.

Mechanical engineering, as we understand it today, starts from the first Industrial Revolution. People have labeled as “revolutions” three episodes in the industrial history of the world and now we are observing the fourth one.

The first industrial revolution took place in England between 1760 and 1840. Metal became the main material of the engineer instead of wood, and steam gave man great reserves of power. This power could drive not only railway engines and ships but also the machines which built them.

During the second revolution, from 1880 to 1920, electricity was the technical driving force. It provided power for factories that was easier and cheaper to control than steam. It was marked also by the growing importance of science-based industries such as chemicals and electrical goods, and the use of scientifically-designed production methods such as semi-automatic assembly lines.

The third industrial revolution coincided with the advent of automation – in its inflexible form. In this revolution, the main features were advances in the control of manufacturing processes so that things could be made more cheaply, with greater precision and often with fewer people. And this change which occurred around the middle of this century, also featured a new machine that was to greatly influence the world, the electronic computer.

The fourth industrial revolution is characterized by automated machines that are versatile and programmable and can make different things according to different sets of computer instructions. It is characterized by flexible, automated machinery, the most interesting example of which are robots.

### *Active Vocabulary*

advent ['ædvent] – прихід

coincide [kəʊɪn'saɪd] – збігатися в часі

engine ['endʒɪn] – двигун

lever ['li:və] – важіль

precision [pri'siʒ(ə)n] – точність

pulley ['pʊli] – шків, блок, барабан

roller – обертовий циліндр, валок, ролик

semiautomatic – напівавтоматичний

steam – водяна пара

versatile ['vɜːsətaɪl] – різнобічний, універсальний

**Ex. 2. Find answers to the questions below**

1. When does the history of mechanical engineering begin?
2. What were the earliest types of machines?
3. What are the four stages of the development of world industry and what are they characterized by?
4. What period of industrial revolution occurs at present?

**Ex. 3. Match the words from the text with their meanings in the right column**

A. Label	1) the arrangement of workers, machines and equipment
B. Provide	2) to make a product
C. Steam	3) to name
D. Assembly line	4) capable of being bent
E. Manufacture	5) water in the form of vapor.
F. Flexible	6) to supply with what is needed

**Ex. 4. Discuss with your partner the questions below**

1. Does an industrial revolution make always good for people?
2. What do you think will be expected results of using robots?
3. How does the industrial revolution influence human life?

**Ex. 5. Listen to the text twice and discuss if technology made our lives better or worse? Prove it.**

Technology is making some aspects of life easier – we don't have to walk everywhere, we can have dinner ready in two minutes, we don't even have to go out to buy the groceries and we don't have to buy books to have something to do on a rainy day.

However, this also means people are getting unfit, less social and more frustrated. People rely on cars to travel small distances and don't do any exercise, they don't spend time developing cooking skills, thus, don't enjoy what has the potential to be an enjoyable activity, don't get to choose the best of the food and often then don't eat healthy food, people spend the day isolated in front of computers, game cubes, play stations, TV sets, wrecking social life and eyes.

Besides, technology is also ruining out environment because of the green-

house gases and other wastes released through the use of electronics

***Ex. 6. Translate the following sentences into English***

1. Для аграрної економіки характерні ручна праця і ремісничє виробництво.
2. Промислова революція – це процес переходу від аграрної економіки до індустріального суспільства з переважанням машинного виробництва.
3. Промислова революція, з технічної точки зору, є переходом від ручної праці до механізованої.
4. Замість мануфактур почалося створення фабрик, які використовували системи машин.
5. Істотно зріс попит на продукти харчування, що спровокувало в Англії сільськогосподарську революцію.
6. На зміну селянам-власникам землі приходили орендарі, які використовували найманих працівників.
7. Якщо продукція ремісників чи мануфактур була занадто дорогою, люди із задоволенням купували дешевші, хоча часто і менш якісні фабричні вироби.
8. Фабрики коштували в кілька разів дорожче, ніж мануфактури, і капітали, накопичені в сільському господарстві.
9. З початком ХІХ століття значно зросла роль зовнішньої торгівлі.
10. Стала помітною роль науки, оскільки до цього здебільшого була епоха інженерів і винахідників, які нерідко не мали ніякої спеціальної освіти.
11. Продукти харчування з часом почали виготовлятися на заводах, з'явилися стандартні і взаємозамінні деталі.
12. У будівництві мостів і кораблів на зміну дереву прийшов метал.

***Ex. 7. Make up a short presentation about industrial revolution in any country of the world***

## UNIT 5

### THE ROLE OF SCIENCE IN MANUFACTURE

#### *Ex. 1. Read and translate the text*

Science plays an important role in our daily life. It has made our life easier, safer, faster and more comfortable.

Scientific inventions – are different engines, the law of gravity, electricity, computers.

Means of communication – buses, cars, trains, ships and planes are the greatest contribution of science. Man can reach any part of the world within hours.

Medicine and surgery – antibiotics and vaccines protect people from diseases that were once feared as deadly, such as measles or syphilis.

Atomic energy – man has got an inexhaustible source of energy. It can meet the demands of energy of the world for a long time.

Future improvements in productivity are largely dependent on the application of science to manufacturing. This depends in turn on the availability of large numbers of scientifically trained engineers.

Nowadays the higher schools can serve the needs of industry in two ways: by performing basic research and by training well-qualified engineers in the manufacturing field.

There is a growing need for engineers who are familiar with the fundamental problems in metal processing and manufacturing. Every year many recent university graduates will become well-qualified engineers. Some of them will come through courses of study in industry. Others, having a basic engineering knowledge will continue additional studies at colleges to prepare themselves for work in industry. Therefore, an engineer does not finish his education when he receives his diploma, particularly in the fields of interest to implement engineers who are to study new developments constantly.

There are numerous ways in which industry and education can cooperate on problems of common interest. Scientists and research engineers are engaged in work that is intended to provide a scientific approach to many purely industrial problems. These scientists and engineers can make a real contribution to engineering education or academic research. They can, for example, propose advanced engineering courses and they can actively participate in basic and applied research.

Similarly, large and complicated projects of new technologies could well be handled by institute researchers working on practical applications. This would often provide the most efficient approach to the solution of processing problems.

#### *Active Vocabulary*

approach – підхід

contribution – внесок

implement – забезпечувати  
 improvement – удосконалення  
 inexhaustible [ɪnɪg'zɔ:stəb(ə)l] – невичерпний  
 intended – призначений  
 invention – винахід  
 measles ['mi:z(ə)lz] – кір  
 metal processing – металообробка  
 research – дослідження  
 surgery ['sɜ:dʒ(ə)rɪ] – хірургія  
 vaccine ['væksɪ:n] – вакцина

**Ex. 2. Find answers to the questions below**

1. Why does science play an important role in our life?
2. How does higher education help to improve manufacture and develop industry?
3. What are future improvements in productivity dependent on?
4. What engineers are necessary nowadays?
5. Who can make a real contribution to academic research?
6. What must a qualified engineer know to meet the needs of industry?
7. How do scientists and engineers contribute to engineering education?
8. What can help to solve the processing problems?
9. Why is it important for scientists to cooperate with industry?
10. Why does an engineer have to continue his education after receiving a diploma?
11. What is the role of science in manufacture?
12. Why is manufacture closely connected to science?

**Ex. 3. Match the words from the text with their meanings in the right column**

A. Availability	1) to act in a certain capacity
B. Serve	2) giving something to someone
C. Research	3) be held
D. Graduate	4) be employed
E. Be engaged	5) the state of being ready for use
F. Contribution	6) a scientific investigation
G. Be handled	7) a person who holds an academic degree

**Ex. 4. Arrange the following sentences according to the logic of the text**

1. Both scientists and engineers can make a contribution to engineering education and academic research.
2. An engineer does not finish his education when he receives his diploma.
3. There is a close cooperation between industry and education.
4. The higher school can serve the needs of industry.

**Ex. 5. Listen to the information about the qualifications and personal characteristics that would be necessary for the job of a mechanical engineer**

If I have a job of a mechanical engineer, I'll need the following skills and abilities:

- determine the causes of technical problems and find solutions for them;
- determine the tools and equipment needed to do a job;
- analyze needs and requirements when designing products;
- repair machines or systems;
- test and inspect products, services, or processes. Evaluate quality or performance;
- design equipment and technology to meet user needs;
- watch gauges, dials, and output to make sure a machine is working properly;
- maintain equipment on a routine basis. Determine when and what kind of maintenance is needed;
- operate and control equipment;
- install equipment, machines, wiring or programs to meet specifications.

**Ex. 6. Translate the following sentences into English**

1. У кінці XV століття в Західній Європі було багато зроблено для розвитку промислового виробництва.
2. Було удосконалене водяне колесо, яке використовувалося як двигун.
3. Попит на метал сприяв удосконаленню доменної печі, що дало можливість одержувати більш якісний метал.
4. У металообробці почали застосовувати молоти для ковки металу та прості види шліфувальних і токарних верстатів.
5. У гірничій справі було впроваджено насоси для відкачування води із шахт і різні підйомні механізми, що позитивно вплинуло на видобуток руди та вугілля.
6. У ткацькому виробництві було вдосконалено ткацький верстат, з'явилася в'язальна машина, що дало можливість збільшити виробництво тканин.
7. Велике значення для створення різних машин і механізмів мало виготовлення годинника з маятником, майбутнього прообразу багатьох машин.

8. Значні досягнення в науці дали можливість удосконалити компас, астролябію, морські карти та атласи.

9. Досягнення у промисловості й сільському господарстві дали можливість значно збільшити обсяги виробництва товарів і товарообіг.

10. Було створено умови для міжнародного поділу праці, світового господарства та світового ринку.

11. Успіхи сучасної техніки, насамперед, залежать від розвитку науки, але не потрібно забувати, що і техніка ставить перед наукою все нові й нові завдання.

12. Рівень розвитку сучасного суспільства визначають досягнення науки і техніки, а технічні нововведення базуються на науково-технічних знаннях.

***Ex. 7. Make up a short presentation about the role of science in manufacture in Ukraine***

## UNIT 6 TECHNICAL ASSISTANCE

### Ex. 1. Read and translate the text

In order to avoid the risk of damage or breakdown of single parts due to long usage any machine and device must be controlled regularly. Sometimes, if a proper maintenance is not done, a fault could occur, with negative consequences on the production process and on the workers' safety. The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment. This includes performing routine actions to keep the device in working order and prevent the failure before it actually occurs (preventive maintenance), or fixing equipment after breakdown (corrective maintenance).

*Preventive maintenance* is designed to preserve and restore equipment reliability by replacing worn components before they actually fail. It includes maintenance activities such as partial or complete overhauls at specified periods, oil changes and lubrication. The ideal preventive maintenance is a combination of technical, administrative and managerial actions to prevent all equipment failure. If carried out properly, preventive maintenance can extend the life of the equipment.

*Corrective maintenance*, sometimes simply called “repair”, is carried out to get equipment working again. It aims at restoring the functionality of a machine so that it can continue to perform its work. This type of maintenance can be very expensive because sometimes equipment needs to be replaced, with substantial costs for the company.

Generally, maintenance is scheduled according to:

- the original equipment manufacturer's recommendations;
- codes and legislation within a country;
- consultancy advice;
- previous maintenance;
- most important measured values and performance indications.

### *Active Vocabulary*

breakdown – поломка механізму

lubrication [lu:'bri'keiʃ(ə)n] – змащування машини

maintenance ['meint(ə)nəns] – догляд, ремонт (поточний), технічне обслуговування, матеріально-технічне забезпечення

mitigate – пом'якшувати, полегшувати

negative consequences – негативні наслідки

overhaul [əʊvə'hɔ:l] – ретельний огляд, капітальний ремонт

prevent – запобігати

reliability – надійність

substantial – солідний, великий



**Ex. 2. Answer to the following questions**

1. Why is maintenance important?
2. What should be done for avoiding the risk of damage?
2. What are the main types of maintenance?
3. What is the function of preventive maintenance?
4. Which activities does it include?
5. What is maintenance called if it occurs after a failure?
6. Why can corrective maintenance be expensive?
7. Is replacement of equipment always substantial for the company?

**Ex. 3. Match the following words with their definitions**

1. Fault	a) damaged and in poor condition as a result of much use
2. To mitigate	b) a set of rules about how something must be done
3. To fix	c) expert advice within a particular field
4. Overhaul	d) applying a greasy substance to reduce friction
5. Worn	e) a break or other defect in a piece of machinery
6. Lubrication	f) to do the necessary work to repair something that doesn't work properly
7. Code	g) to make something less severe or unpleasant
8. Consultancy	h) a careful examination of a machinery or system that must be repaired

**Ex. 4. Translate the following sentences into English**

1. Ремонт усуває фізичний знос і відновлює роботопридатність обладнання.
2. З часом подальший ремонт стає економічно недоцільним.
3. Зношування відбувається настільки інтенсивно, що витрати на ремонт стають однаковими або більшими від вартості нового обладнання, тобто деталь, вузол чи обладнання досягнули граничного зносу.
4. Технічне обслуговування містить роботу з огляду обладнання, перевірку на точність, промивання, змащення і т. д.
5. Необхідними умовами нормального перебігу виробничих процесів на підприємстві є постійне підтримування в робочому стані машин та устаткування.
6. У межах системи технічного обслуговування виробництва виконуються різні функції.
7. Функції системи технічного обслуговування містять ремонт техно-

логічного, енергетичного, транспортного та іншого устаткування, догляд за ним і налагоджування.

8. Машини та устаткування складаються з багатьох конструктивних елементів, які в процесі експлуатації зазнають різних навантажень, і тому зношуються нерівномірно.

9. Підрозділи, що входять до складу ремонтного господарства, здійснюють технічне обслуговування та ремонт засобів праці, монтаж і введення в дію нового устаткування, виготовлення запасних частин і нестандартного обладнання, модернізацію діючих машин та устаткування.

10. Для того, щоб заощадити матеріальні й енергетичні ресурси, оптимізувати процес технічного обслуговування, потрібно забезпечити раціональну експлуатацію основного технологічного обладнання.

11. Вимушений ремонт на фабриці може бути викликаний пошкодженням конвеєрів, електрообладнання, основного і допоміжного технологічного обладнання.

***Ex. 5. Make up a short presentation about preventive maintenance or corrective maintenance***

## UNIT 7 SMART MATERIALS

### ***Ex. 1. Read and translate the text***

The world of engineering was changed by appearing an invention called smart – or shape memory – materials. There are two types of such materials: metal alloys and plastic polymers. The metal alloys were made first and they are usually an expensive mixture of titanium and nickel.

Shape memory materials are called “smart” because they react to changes in their environment. One can mention the following shape memory materials:

- *plastics* that return to their original shape when the temperature changes. One use is in surgery where plastic threads “remember” the shape of a knot, react to the patient’s body temperature and make themselves into stitches;

- *metal alloys* that have a “memory” and can return to their original shape. They are used in medical implants that are compressed so they can be put inside the patient’s body through a small cut. The implant then expands back to its original shape. More everyday uses are for flexible spectacle frames and teeth braces;

- *solids* that darken in sunlight, like the lenses in some sunglasses;

- *liquid crystals* that change shape and colour. These have been used in climbing ropes that change colour if there is too much strain and weight on them.

The future of these materials and their possible uses is limited only by human imagination. One clever idea is that if cars were made of smart metal, a minor accident could be repaired by leaving the car in the sun.

### ***Active Vocabulary***

alloy – сплав

implant ['implɑ:nt] – вживлена тканина, орган, імплантант

knot – вузол

shape memory materials – матеріали з ефектом пам’яті форми

solid – тверде тіло

stitch – стібок, шов

strain – натягування, деформація

teeth brace – ортодонтичні скоби, пластинки

thread [θred] – нитка

### ***Ex. 2. Complete the definitions below with the words from the text***

1. An \_\_\_\_\_ is something medical put inside the body.
2. You need a good \_\_\_\_\_ to think of new and interesting ideas.
3. \_\_\_\_\_ are materials made from mixing two metals.
4. To \_\_\_\_\_ means to become bigger
5. To \_\_\_\_\_ is to change because something else happens.

6. The \_\_\_\_\_ is everything around a person or thing.  
 7. To be \_\_\_\_\_ means to be made smaller.

**Ex. 3. Choose the answers to the questions below**

1. Smart materials change when	a) the weather changes. b) something affects them. c) the light is switched on.
2. Plastic threads are used for	a) sewing. b) stitching. c) knitting.
3. Medical implants made from shape memory alloys are good because	a) they save lives. b) they change colour. c) they are easy to put in.
4. Climbing ropes with liquid crystals change colour to	a) warn you. b) amuse you. c) make you heavy.

**Ex. 4. Discuss with your partner ideas below**

Choose one of the smart materials in the text. Think of three interesting ways it could be used. Compare your ideas with other students. How many original ideas are there in your group? Do you think the materials are clever, fashionable or formal?

**Ex. 5. Translate the following sentences into English**

1. Сплав – це тверда або рідка однорідна речовина, утворена сплавленням кількох металів або металів з неметалами.
2. Усі сплави у твердому стані, зазвичай, мають кристалічну будову.
3. Багато сплавів, наприклад, бронза, сталь, чавун, були відомі давно й уже тоді мали велике практичне застосування.
4. Багато властивостей сплавів значно кращі, ніж у чистих металів, що входять до їхнього складу.
5. Метали і неметали, з яких складається сплав, називаються компонентами сплаву.
6. Температура плавлення сплавів, зазвичай, є нижчою від температури металів, що входять до їхнього складу.

7. Вироби з чистого золота легко деформуються, стираються, тому для виготовлення ювелірних виробів застосовують сплав золота з міддю.

8. Основою сплавів слугують такі метали, як: залізо, мідь, алюміній, магній, титан.

9. Найбільше значення у сучасній техніці мають сплави заліза з вуглецем, а не чисте залізо.

10. Для авіації застосовують легкі сплави на основі магнію, титану, алюмінію.

11. Використання вольфраму, кобальту, нікелю мають велике значення для металообробної промисловості.

12. Для машинобудування необхідні легкі сплави, нерозчинні в кислотах, стійкі в агресивних газових середовищах, теплопровідні, магнітні або немагнітні.

***Ex. 6. Make up a short presentation about smart materials***

## UNIT 8 METALS

### *Ex. 1. Read and translate the text*

If you look around you, you will see that many of the things we use in our daily life have metal in them. Metals are substances that are mined from the earth where they were formed a long time ago. When metals are mined, they are found mixed with rocks and earth in a form called ore. The most common ores are iron and bauxite. Aluminum, a metal used for many household objects, is made from bauxite. There are as many as seventy different kinds of metals, but iron is the most commonly used. After iron ore is mined the rocks and dirt must be separated from the metal. This process is called smelting and is done by heating the ore in giant blast furnaces.

The ore is placed in a steel furnace which is lined with bricks. Then a special kind of coal, called coke, is added along with limestone. Hot air is forced into the furnace, heating the mixture to 1.600 degrees centigrade. The metal in the ore becomes liquid and sinks to the bottom. Other substances rise to the top and are skimmed off. These waste products are called slag and are worthless. The liquid iron is then poured out into a mold to cool and become solid. Later, it can be heated again and molded to make useful items. If it is to be made into steel, iron is melted again and mixed with carbon in another careful process. There are many kinds of steel, and the process for making each kind is different.

The properties of the steel are affected by the inclusion of other elements. 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 rustproof steels. Heating in the presence of carbon or nitrogen-rich materials is used to form a hard surface on steel (case-hardening). 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*

bauxite ['bɔ:ksaɪt] – боксит, алюмінієва руда

case-hardening – поверхнєве зміцнення

core – серцевина, сердечник

furnace ['fɜ:nɪs] – піч (технічна)

limestone – вапняк

molybdenum [mə'libdɛnəm] – молибден

mould – форма

ore – руда

rustproof – нержавіючий, корозійно-стійкий

slag [slæg] – шлак, окалина

smelting – плавка, плавлення  
 substance ['sebstəns] – речовина  
 tungsten ['tvəstən] – вольфрам  
 vanadium [və'neɪdɪəm] – ванадій

**Ex. 2. Find answers to the questions below**

1. What equipment and materials are needed to extract iron from iron ore?
2. How is steel made?
3. How does different inclusion of other elements influence the properties of the steel?
4. Why are metals essential in today's life?

**Ex. 3. Match the words from the text with their meanings in the right column**

A. Mine	1) the ore from which aluminum is made
B. Furnace	2) baked clay
C. Process	3) to dig a hole in order to obtain something
D. Brick	4) extremely large
E. Bauxite	5) an enclosed space in which a hot fire is made to extract metals from ores
F. Giant	6) a rock from which metal can be obtained
G. Liquid	7) a substance which is not a solid or a gas
H. Ore	8) a connected set of actions which are carried out to obtain a particular result

**Ex. 4. Arrange the following sentences according to the process of melting described in the text**

1. The liquid iron is poured out into a mold to cool and become solid.
2. The ore is put in a steel furnace.
3. A coke is added with limestone.
4. The metal in the ore becomes liquid and sinks to the bottom.
5. Hot air is forced into a furnace.
6. Slag rises to the top and is skimmed off.

**Ex. 5. Translate the following sentences into English**

1. Залізо та його сплави, безперечно, є основними технічними матеріалами.

2. Із чорних металів виготовляють верстати, автомобілі, кораблі, мости, сільськогосподарські машини, труби, інструменти та побутові вироби.

3. Алюмінієві сплави посідають друге місце серед конструкційних матеріалів.

4. Суміші порошку магнію з окисниками використовують для виготовлення освітлювальних і запалювальних ракет.

5. Титан використовують для виготовлення хімічної апаратури та в різних галузях машинобудування.

6. Алюмінієві сплави стійкі до атмосферної корозії, порівняно дешеві, простіше добуваються та обробляються.

7. Висока жаростійкість титану та його сплавів робить їх дуже цінними матеріалами для літако- і ракетобудування.

8. Хірурги використовують танталові пластинки, дріт, стержні, шурупи для скріплення кісток.

9. Метали належать до числа найпоширеніших матеріалів, які людина використовує для забезпечення своїх життєвих потреб.

10. Алюмінієві сплави застосовують у ракетній техніці, авіа-, авто-, судно- та приладобудуванні.

11. Сплави титану добре сумісні з живою тканиною, тому з них виготовляють медичні інструменти.

12. Механічні властивості металів є найважливішими.

***Ex. 6. Make up a short presentation about the way metals are produced using the following phrases***

1. First iron ore is mined.
2. Then ... / Secondly ... .
3. After that ... / Thirdly... .
4. Later... .
5. In the end ... / Finally ... .



## UNIT 9

### MATERIALS

#### *Ex. 1. Read and translate the text*

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

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

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

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

PVC or polyvinyl chloride is a type of plastic and is used to insulate wires and cables: Rubber is a polymer and its best property is elasticity, as it returns to its original size and shape after deformation.

Ceramic materials are good insulators: hard, resistant and strong, but brittle. Composite materials are made up of two or more materials combined to improve their mechanical properties.

Concrete is reinforced with steel and is used in building engineering.

#### *Active Vocabulary*

brass [brɔ:s] – латунь, жовта мідь

brittle – крихкий, ламкий

chloride ['klɔ:raɪd] – хлорид

concrete – бетон

copper – мідь

ferrous ['ferəs] – залізистий, який містить двовалентне залізо

insulate ['ɪnsjʊleɪt] – ізолювати

non-ferrous – кольоровий (про метал)

pasty ['pæsti] – в'язкий

property – властивість, характеристика

rubber – гума, каучук

tin – олово

wire [waɪə] – дріт

**Ex. 2. Find answers to the questions below**

1. What is the basic classification of metals?
2. What specific knowledge is required for building machinery or tools?
3. What are the main types of materials used in mechanical engineering?
4. What are the characteristics of iron?
5. Why are alloys created?
6. Which materials are good insulators?
7. Is steel an alloy?

**Ex. 3. Match the words with their definitions**

A. Alloy	1) a type of plastic used for insulation
B. Steel	2) a combination of different metals
C. Pvc	3) an alloy formed by mixing iron and carbon
D. Concrete	4) an alloy formed by mixing copper and zinc
E. Brass	5) metals containing iron
F. Ferrous materials	6) a composite material used to build houses
G. Ceramic	7) a metal not suitable as structural material
H. Iron	8) a good insulator but brittle

**Ex. 4. Complete the definitions with the words in the box**

*Cooking, coins, alloy, air, copper, wires, steel, carbon, gold, ferrum, expensive, ductile*

Iron: Its Latin name is (1) \_\_\_\_\_. It is magnetic and has a silvery colour. In prehistoric times it was used to make ornaments and weapons. If exposed to the (2) \_\_\_\_\_, it oxidises. (3) \_\_\_\_\_: It is one of the most widely used metals by humans. In prehistoric times it was used to make cooking utensils, (4) \_\_\_\_\_ and ornamental objects. It is used in (5) \_\_\_\_\_ and cables. (6) \_\_\_\_\_: It is the most (7) \_\_\_\_\_ metal and is used to create precious jewel-

lery. It is the most (8) \_\_\_\_\_ metal. (9) \_\_\_\_\_: It is an (10) \_\_\_\_\_ formed from iron and (11) \_\_\_\_\_. It can contain between 2,1% and 4% carbon. It is also used for (12) \_\_\_\_\_ utensils and pans.

***Ex. 5. Translate the following sentences into English***

1. У загальному випадку матеріали в конструкціях можуть зазнавати різних за видом навантажень, що спричиняють появу різних видів деформацій: розтягу, стискання, згину, кручення, зсуву або їхньої сукупності.

2. Різноманітними є і умови експлуатації матеріалів за температурою, видом навколишнього середовища, швидкістю прикладання навантаження та законом його зміни у часі.

3. Існує багато показників механічних властивостей і, відповідно, багато методів механічних випробувань.

4. Для металів та конструкційних пластмас найпоширенішими є випробування на розтягування, твердість, згинання та ударний згин.

5. Крихкі конструкційні матеріали (наприклад, скло, кераміку, метало-кераміку) переважно випробовують на стискання і статичний згин.

6. Механічні властивості композиційних матеріалів важливо оцінювати, також, в умовах випробування на зсув або кручення.

7. Міцність матеріалів, що реалізується в елементах конструкцій, залежить не тільки від механічних властивостей самого матеріалу, а й від форми та розмірів деталі.

8. Міцність матеріалів залежить не тільки від механічних властивостей самого матеріалу, а й від пружної енергії, накопиченої в навантаженій конструкції.

9. Міцність матеріалів залежить не тільки від механічних властивостей самого матеріалу, а й від характеру впливу навантаження.

10. Схеми прикладання зовнішніх сил та робоча температура в комплексі спричиняють так звану конструкційну міцність.

11. Основними механічними властивостями металів є міцність, твердість, пружність, пластичність, крихкість, ударна в'язкість, витривалість, опір крутінню.

***Ex. 6. Make up a short presentation about the usage of materials in different spheres of our life***

## UNIT 10 MACHINE TOOLS

### *Ex. 1. Read and translate the text*

A machine tool is a machine for shaping or machining metal or other rigid materials, usually by cutting, boring, grinding, shearing, or other forms of deformation. All machine tools have some means of constraining the workpiece and provide a guided movement of the parts of the machine.

A machine tool is a sort of machine used as a tool in the making of other machines. Machine tools were powered in the Middle Ages by humans and animals, and later by the energy captured by waterwheels. After the Industrial Revolution, most machine tools were powered by steam engine and nowadays by electricity.

Machine tools can be operated manually or under automatic control. In the 1960s, computers gave more flexibility to the process. Such machines became known as computerized numerical control (CNC) machines. They could precisely repeat sequences, and could produce much more complex pieces than even the most skilled tool operators. Let's examine the main features of some of the most commonly used machine tools.

#### *Turning machine*

The engine lathe is the most important of all the machine tools. It is used to produce external or internal cylindrical surfaces. The piece is held by the machine and is rotated while a cutting tool removes excess metal from the external diameter. Internal turning consists of enlarging and finishing a hole.

#### *Drilling machine*

It is used to produce circular holes in metal with a twist drill. It also uses a variety of other cutting tools to perform the basic hole-machining operations.

#### *Shape*

This is a metal-cutting machine used to produce or modify flat surfaces. The cutting tool moves cutting on the forward stroke, with the piece feeding automatically towards the tool during each return stroke. Shapers can be horizontal or vertical.

#### *Milling machine*

This cuts flat metal surfaces. The piece is fed against a rotating cutting tool. Cutters of many shapes and sizes are available for a wide variety of milling operations. Milling machines may be manually operated, mechanically automated, or digitally automated via computer numerical control (CNC).

#### *Grinding machine*

This removes excessive material from parts that are brought into contact with a rotating abrasive wheel. Grinding is the most accurate of all the basic machining processes, but also the most time consuming.

#### *Press*

This is a machine tool that changes the shape of a workpiece. Historically,

metal was shaped by hand using a hammer. Machine presses can be dangerous.

### *Band saw*

It is a power tool which uses a blade consisting of a continuous band of metal with teeth along one edge. The band usually rides on two wheels rotating in the same plane. Band saws are used for woodworking, metalworking, or for cutting a variety of other materials, and are particularly useful for cutting irregular or curved shapes. A constant flow of liquid is poured over the blade to keep it cool and preventing it from overheating.

### *Active Vocabulary*

abrasive – шліфувальний

blade – лезо

boring – свердління

constraining – стримувальний, обмежувальний

grinding ['graɪndɪŋ] – помел, подрібнювання, шліфування

lathe – токарний верстат

machine tool – верстат, металорізальний верстат

machining – механічна обробка

numerical control – числове управління

rigid ['rɪdʒɪd] – жорсткий, твердий, негнучкий

sequence – послідовність

shaping – надання форми, вигляду

shearing – зріз

stroke – хід поршня, клапана, такт роботи двигуна

turning machine – токарний станок

workpiece – оброблювана деталь, заготовка

### *Ex. 2. Decide if the following sentences are true (T) or false (F)*

1. Turning machines remove excess metal from the external diameter and enlarge and finish a hole.

2. In the Middle Ages most machine tools were powered by electricity and steam engines.

3. CNC machine means central nervous control machine.

4. Shapers can only be vertical.

5. Drilling machines use a twist drill to make circular holes.

6. Milling machines can only be manually operated.

7. The engine lathe is the most important of all the machine tools.

8. Grinding machines remove excessive material from parts.

9. Band saws use a band of metal with teeth to cut various parts.

10. Presses are not dangerous if operated by both hands.

11. Machine tools can be operated only under automatic control.

12. A constant flow of liquid is poured over the blade to keep it overheated.

**Ex. 3. Complete the table**

MACHINE TOOL	FINAL RESULT	DESCRIPTION
turning machine	external and internal flat surface	It removes excess metal from the external diameter. It enlarges and finishes a hole.
	specific shape	It cuts flat metal surfaces.
	holes	It uses a twist drill to make holes.
	flat surface	It cuts the piece.
	specific shape	It changes the shape of a workpiece.
	cut pieces	It cuts various parts using a continuous band
	finishing	It removes excessive material from parts

**Ex. 4. Translate the following sentences into English**

1. Леонардо да Вінчі винайшов токарний верстат, у якого рух шпинделя відбувався за допомогою ножної педалі.

2. У XVII столітті в Київській Русі з'явилися перші спеціальні майстерні-токарні, які займалися виготовленням дерев'яного посуду.

3. Перший токарний автомат з магазином, із розподільчим валом, з плоскими і циліндричними кулачками був створений Спенсером у 1873 році.

4. У конструкції деревообробного верстата, зазвичай, використовується обертовий високошвидкісний механізм обертового руху.

5. У 1490 році Леонардо да Вінчі винайшов пристосування для підтримки різального інструмента.

6. На токарних верстатах застосовують різноманітний різальний інструмент.

7. Матеріал різального інструмента має добре працювати на вигин і стиск.

8. Свердлильні верстати використовують у механічних, складальних, ремонтних та інструментальних цехах машинобудівних заводів і в підприємствах малого бізнесу.

9. Матеріал різального інструмента повинен мати гарну теплопровід-

ність, добре шліфуватися і прожарюватися.

10. Свердлильний верстат 2М112 призначений для свердління отворів у деталях із чорних і кольорових металів.

11. Токарний верстат призначений для впливу на деревину, шляхом обробки її фрезою, ножовим валом, свердлом чи іншим різальним інструментом.

12. Простота конструкції забезпечує легкість управління, надійність і довговічність верстатів.

***Ex. 5. Make up a short presentation about different machine tools***

**PART 2**  
**TEST 1**  
**TYPES OF JOBS IN ENGINEERING**

*Choose the correct answer*

1. .... includes the design and construction of buildings, roads, bridges and dams. It is one of the oldest forms of engineering and involves further specialist areas such as transportation, water resources, surveying and construction.

- a) civil engineering
- b) mechanical engineering
- c) electrical engineering
- d) genetic engineering

2. .... deals with the application of mechanical power and the design of mechanical systems, machines and tools. Engineers require an understanding of a number of important principles including those related to heat transfer, energy, fluid mechanics and kinematics.

- a) civil engineering
- b) mechanical engineering
- c) electrical engineering
- d) genetic engineering

3. .... includes the study of electricity and the design of electrical systems like circuits and computer chips. Some of the areas electrical engineers might work in include telecommunications, electronics, signal processing and control systems.

- a) civil engineering
- b) mechanical engineering
- c) electrical engineering
- d) military engineering

4. .... uses science to process raw materials and chemicals into useful forms.

- a) software engineering
- b) nuclear engineering
- c) civil engineering
- d) chemical engineering

5. .... involves the manipulation of an organism's genes. Engineers directly alter genes using techniques such as molecular cloning and transformation.

- a) genetic engineering
- b) nuclear engineering
- c) civil engineering



d) military engineering

6. .... combines computer science and electronic engineering in order to design computer technology from the very small, such as microprocessors, to the very big, such as supercomputers.

- a) computer engineering
- b) genetic engineering
- c) civil engineering
- d) military engineering

7. .... involves research, design and modification in order to implement fast, high quality software in a range of areas, apply a variety of principles and techniques to computers and other products that use software.

- a) software engineering
- b) computer engineering
- c) civil engineering
- d) military engineering

8. .... incorporates the design and construction of various military structures and devices. They are involved in activities such as weapons design and bridge construction.

- a) military engineering
- b) software engineering
- c) computer engineering
- d) civil engineering

9. Usually regarded as part of civil engineering, .... involves the design of buildings, large structures and other things that rely on the importance of structural integrity. They must pay particular attention to safety because of the huge loads involved.

- a) structural engineering
- b) mechanical engineering
- c) electrical engineering
- d) military engineering

10. .... applies various scientific principles and ideas to help provide clean water, minimize pollution and improve the environment. They work in a number of areas that can relate to air pollution, waste disposal, recycling, global warming, water pollution and other environmental issues.

- a) environmental engineering
- b) mechanical engineering
- c) electrical engineering
- d) military engineering

**TEST 2**  
**BASIC MECHANICAL ENGINEERING**

*Answer the following questions*

1. Which of the following is a power transmitting element?
  - a) nuts and bolts
  - b) sprockets and chains
  - c) axles
  - d) all of the above
  
2. Machine elements such as bearings are \_\_\_\_\_
  - a) holding type elements
  - b) supporting type elements
  - c) power transmitting elements
  - d) all of the above
  
3. The shaft directly connected to the power source is called as \_\_\_\_\_
  - a) line shaft
  - b) counter shaft
  - c) both a. and b.
  - d) none of the above
  
4. Which of the following is a machine shaft?
  - a) line shaft
  - b) counter shaft
  - c) crankshaft
  - d) all of the above
  
5. Which of the following statements is true?
  - a) axles are used to transmit power
  - b) shafts and axles are rotating elements
  - c) shafts transmit power while axles do not transmit power
  - d) all of the above
  
6. Which of the following is not a reason to design and redesign a product?
  - a) optimum design
  - b) innovation
  - c) appearance
  - d) none of the above
  
7. In design process, which process is followed after selecting the material?
  - a) selecting factor of safety
  - b) synthesis

- c) analysis of forces
- d) determining mode of failure

8. Which design consideration deals with appearance of the product?

- a) ergonomics
- b) aesthetics
- c) system design
- d) creative design

9. Hardness of a material enables it to resist \_\_\_\_\_

- a) abrasion
- b) penetration
- c) plastic deformation
- d) all of the above

10. The component deforming progressively under load at high temperatures is called as

- a) resilience
- b) creep
- c) fatigue
- d) all of the above

11. Which of the following is not a property of copper alloy?

- a) high electrical conductivity
- b) high thermal conductivity
- c) high strength
- d) none of the above

12. In which of the following processes, material is neither added nor removed but is deformed into desired shape?

- a) surface finishing process
- b) metal forming process
- c) casting
- d) machining

## TEST 3 AUTOMATION

*Read the statement and choose the correct answer*

1. A step beyond mechanization is .....

  - a) automation
  - b) electrification
  - c) mass production
  - d) simplification

  
2. Early ..... such as the glass bottle blowing machine required a lot of operator involvement.

  - a) production machinery
  - b) hand/muscle power
  - c) combustion engines
  - d) program controlled

  
3. By the 1920s fully automatic machines, which required much less ....., were being used.

  - a) measurement
  - b) operator attention
  - c) production machinery
  - d) electrification

  
4. Automation or automatic control, is the use of various ..... for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention.

  - a) control systems
  - b) control actions
  - c) operations
  - d) mechanisms

  
5. The biggest benefit of automation is that it saves ....., however, it is also used to save energy and materials and to improve quality, accuracy and precision.

  - a) labour
  - b) industry
  - c) mechanisms
  - d) machinery

6. Automated manufacturing improves work flow and ..... the morale of workers when a good implementation of the automation is made.

- a) increases
- b) decreases
- c) declines
- d) rises

7. The term automation, inspired by the earlier word automatic (coming from automaton), ..... widely ..... before 1947, when Ford established an automation department.

- a) was used
- b) has been used
- c) would be used
- d) wasn't used

8. The ..... of automation cannot be seen only in terms of a reduction of cost and time.

- a) purpose
- b) reason
- c) explanation
- d) statement

9. There are automated engines that ..... more energy resources from the Earth in comparison with previous engines and those that do the opposite.

- a) spend
- b) buy
- c) consume
- d) produce

10. Hazardous operations, such as oil refining, the manufacturing of industrial chemicals, and all forms of metal working, were always early contenders for .....

- a) automation
- b) industry
- c) mass production
- d) simplification

## TEST 4

### INDUSTRIAL REVOLUTIONS

#### *Read and discuss*

In 19th century Europe and the United States, changes continued to occur in technology and the social order. This period is referred to as the Industrial Revolution. Factories were built in the larger cities, with mechanized assembly lines for mass production of goods. For the first time, a new working class was earning wages in factory jobs. As the people in the United States and throughout most of Europe had achieved independence from foreign rulers, each nation now had to face its own economic problems and deal with the changes caused by the Industrial Revolution. Populations moved from a mostly rural existence to crowded cities where workers formed a large part of the community. The telegraph and telephone provided means of long distance communication, which brought people and communities closer together. The business leaders gained great wealth. They often did so at the expense of poorly paid factory workers while working conditions of the period were terrible.

1. Everyone got rich during the Industrial Revolution.  
A. True  
B. False
  
2. The telegraph and the telephone were not important inventions.  
A. True  
B. False
  
3. Many people moved to the cities to get jobs in factories.  
A. True  
B. False
  
4. The middle class had always worked for wages in factories.  
A. True  
B. False
  
5. Business leaders thought that the factories were a good idea.  
A. True  
B. False

The Industrial Revolution was the change in the economy's character from a manual means of production to a mechanical one. Goods were mass-produced by machinery rather than crafted by hand. Because of this change in production methods, more goods could be produced at lower costs. Great Britain is generally credited as the place of origin of the Industrial Revolution. By the late 19th

century, the United States, with its abundant natural resources and growing population, had become the world's industrial leader, further cementing its position as a world power. The number of factories in the United States grew, attracting people from rural areas who could earn more money working in urban factories than on farms. As a result, the population of the cities grew. With increased earnings, people could buy more goods and improve the quality of their lives. This consumer demand encouraged existing businesses to expand, new products to be created, and new industries to be developed.

6. Industry attracted people from rural areas to the cities.

A. True

B. False

7. Consumer demand encouraged business growth.

A. True

B. False

8. Increased earnings did nothing to improve the quality of life.

A. True

B. False

9. The Industrial Revolution began in the United States.

A. True

B. False

10. The Industrial Revolution increased the population in rural areas.

A. True

B. False

## TEST 5 MANUFACTURING CROSSWORD PUZZLE

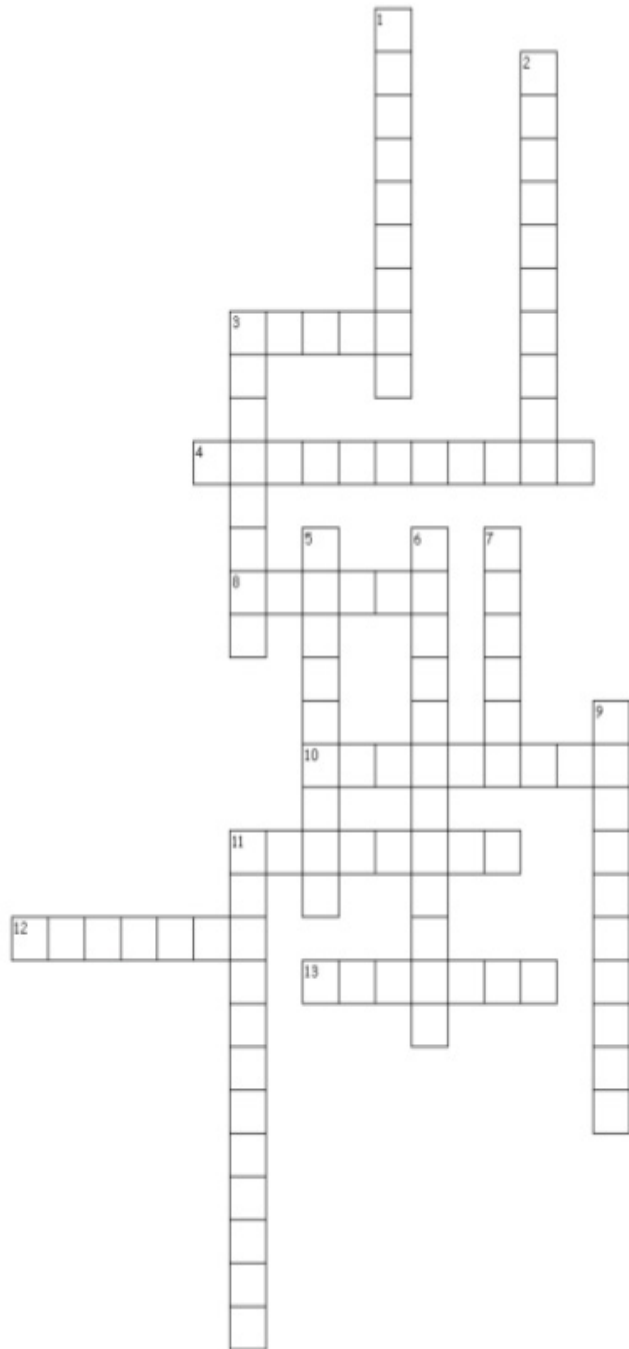
*Use the following words to fill in the crossword: bottom line, budget, cold call, credit rating, deliverables, foreman, headhunter, incentive, marketing, principle, revenue, stakeholder, strike, union, unit cost.*

**Across**

- 3. An organization whose membership is workers united
- 4. A person that has an investment in a business or industry
- 8. A refusal to work by employees as a form of protest
- 10. Something that motivates or encourages you to buy a product
- 11. A visit to a client with no prior notice
- 12. Money that is made by or paid to a business
- 13. A supervisor who directs other workers

**Down**

- 1. Promoting and selling your product or service
- 2. The final total of an account
- 3. The cost incurred to produce one item
- 5. The money originally invested
- 6. Services or goods you are providing
- 7. A plan for income and expenses
- 9. A person who identifies suitable candidates for jobs
- 11. An estimate of your ability to meet your financial obligations





**TEST 6**  
**TECHNICAL ASSISTANCE**

*Read the statements and choose the correct answer*

1. In many commercial buildings, heating and cooling engineers perform ..... tasks on furnaces, boilers, and air conditioners.
  - a) operational maintenance
  - b) corrective maintenance
  - c) preventive maintenance
  - d) care and maintenance
  
2. .... tends to follow planned guidelines from time-to-time to prevent equipment and machinery breakdown.
  - a) operational maintenance
  - b) corrective maintenance
  - c) preventive maintenance
  - d) care and maintenance
  
3. .... is a term used in the mining industry to describe processes and conditions on a closed mine site where there is potential to recommence operations at a later date.
  - a) operational maintenance
  - b) corrective maintenance
  - c) preventive maintenance
  - d) care and maintenance
  
4. .... is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations.
  - a) operational maintenance
  - b) corrective maintenance
  - c) preventive maintenance
  - d) care and maintenance
  
5. Maintenance, including tests, measurements, adjustments, parts replacement, and cleaning, performed specifically to ..... faults from occurring.
  - a) prevent
  - b) stop
  - c) correct
  - d) make
  
6. Preventive maintenance for various ..... and facilities is quite nuanced.
  - a) equipment

- b) items
- c) resources
- d) parts

7. This type of maintenance can be very ..... because sometimes equipment needs to be replaced, with substantial costs for the company.

- a) expensive
- b) cheap
- c) low in price
- d) inexpensive

8. The ideal preventive maintenance is a combination of technical, administrative and managerial actions to prevent all equipment .....

- a) failure
- b) mistake
- c) inaccuracy
- d) lack of success

9. Sometimes, if a proper maintenance ....., a fault could occur, with negative consequences on the production process and on the workers' safety.

- a) is not done
- b) was not done
- c) won't be done
- d) is done

10) We can efficiently eliminate any deficiencies since technical equipment cannot function with maximum ... without maintenance.

- a) efficiency
- b) possible output
- c) effort
- d) monitoring

## TEST 7

### MANUFACTURE OF PLASTICS AND RECYCLING

#### *Read and discuss*

Plastics can be classified by their chemical structure, namely the molecular units (micro structure) that make up the polymer's backbone and side chains. Plastics can also be classified by the chemical process used in their synthesis, like condensation or polyaddition. Other classifications are based on qualities that are relevant for manufacturing or product design. Examples of such classes are the biodegradable and electrically conductive plastics.

Oil refining produces raw materials for plastics: about 4% of produced crude oil is used yearly in manufacturing plastic products. Plastics, synthetic rubber and synthetic fibres are made of small-molecular organic compounds by polymerizing. Polymerization is a reaction in which large numbers of small structural units are attached together into a giant molecule. Many common plastics are manufactured like this. A plastic manufactured by polymerizing is commonly called a polymer. Polymers can be categorized on the basis of their production method, properties, use or the structure of the polymer chain.

About 150 million tons of different kinds of plastics are manufactured yearly in the world. Plastics are light and handy, and easy to cast and attach together. In the newest plastics, it is possible to combine the best properties of metals and plastics. Plastics can be made stronger with natural fibres, which make them stronger and firmer and more pro-environmental to manufacture and use.

Plastic objects are manufactured by casting and pressing. Foils are manufactured by pressing the melted plastic pulp into thin sheets between rotating rollers or by blowing plastic bubbles from it. If the foil is tightened in the manufacturing phase, the tightening leaves tension in the foil. The tensions are discharged in heating and the foil shrinks. For example, yoghurt pots can be restored to their original sheet-like forms when heated carefully.

Plastics extrusion is a high volume manufacturing process in which raw plastic material is melted and formed into a continuous profile. Extrusion produces items such as pipe/ tubing, weather stripping, window frames, adhesive tape and wire insulation.

The thermosetting plastic objects are made by a direct casting process. In the process the unfrozen plastic mass is pressed through the nozzle to the mould. The plastic part solidifies quickly in the mould. So the making of plastic objects is quick.

The thermoplastics can be recycled and reused. The reuse is reasonable when plastic waste has been sorted on the basis of a type of plastic and colour. Also the miscellaneous plastic waste can be used. For example, plastic planks can be made from the mixed waste.

Most plastics can be burnt as energy waste without the emission of harmful substances. The temperature of the burning material must then be kept above

300°C throughout the burning process to avoid forming of harmful compounds. The burning then results only in carbon dioxide and water from the clean plastics. However, the pigments and additives used in production of plastics could form poisonous compounds when plastic is burned. PVC plastics are unsuitable for burning because of the chlorine, among other things, contained in them.

1. What products are manufactured from
  - a) thermoplastics
  - b) thermosetting plastics
  
2. Generate at least five ideas for recycling
  - a) plastic bottle
  - b) plastic bag
  - c) pasteboard
  - d) plastic pack used for mince
  
3. What materials can you use instead of plastics for a purpose of your choice? Give five examples.

**TEST 8**  
**MECHANICAL PROPERTIES OF MATERIAL**

*Choose the correct answer*

1. Brittleness is .....
  - a) ability of a material to break or shatter without significant deformation when under stress; opposite of plasticity
  - b) maximum stress a material can withstand before compressive failure
  
2. Creep is .....
  - a) the slow and gradual deformation of an object with respect to time
  - b) ability of a material to deform under tensile load
  
3. Ductility is .....
  - a) ability of a material to deform under tensile load
  - b) ability of a material to absorb energy when it is deformed elastically
  
4. Elasticity is .....
  - a) ability of a body to resist a distorting influence or stress and to return to its original size and shape when the stress is removed
  - b) maximum stress a material can withstand
  
5. Hardness is .....
  - a) ability to withstand surface indentation and scratching
  - b) ability of a material to undergo irreversible or permanent deformations without breaking or rupturing; opposite of brittleness
  
6. Resilience is .....
  - a) maximum stress a material can withstand
  - b) ability of a material to absorb energy when it is deformed elastically; combination of strength and elasticity
  
7. Specific strength is .....
  - a) strength per unit density (Nm/kg)
  - b) combination of strength and elasticity

8. Specific weight is .....

- a) weight per unit volume ( $\text{N/m}^3$ )
- b) strength per unit density ( $\text{Nm/kg}$ )

9. Stiffness is .....

- a) maximum stress a material can withstand
- b) ability of an object resists deformation in response to an applied force, rigidity, complementary to flexibility

10. Flexibility is .....

- a) strength per unit density
- b) ability of an object to bend or deform in response to an applied force, pliability, complementary to stiffness

**TEST 9**  
**FERROUS AND NON-FERROUS METALS AND THEIR USES**

*Choose the correct answer*

1. Ferrous metals are those which .....
  - a) contain iron
  - b) don't have any iron content
  
2. Non ferrous metals .....
  - a) don't have any iron content
  - b) contain iron
  
3. Mild steel .....
  - a) used for engineering purposes and in general
  - b) used to make cutting tools such as drill bits
  
4. Carbon steel .....
  - a) used to make cutting tools such as drill bits
  - b) used in general
  
- 5) Stainless steel .....
  - a) used for the likes of cutlery and surgical instrumentation
  - b) used to make items such as ornamental gates and fencing
  
6. Cast iron .....
  - a) used in general
  - b) used to manufacture items such as engine blocks and manhole covers
  
7. Wrought iron .....
  - a) used to manufacture items such as engine blocks
  - b) used to make items such as ornamental gates and fencing
  
8. Aluminium .....
  - a) used in aircraft manufacture, window frames and some kitchen ware
  - b) used for wiring, tubing and pipe work

9. Copper .....

- a) used for wiring, tubing and pipe work
- b) used for ornamental purposes

10. Silver .....

- a) used for decorative impact in jewellery and ornaments
- b) used in roofing, in batteries and to make pipes

11. Zinc .....

- a) a silvery-white metal which is a constituent of brass and is used for coating (galvanizing) iron and steel to protect against corrosion
- b) a yellow precious metal used in jewellery and decoration to guarantee the value of currencies

12. Element .....

- a) each one is distinguished by its atomic number
- b) used to emphasize a large extent or number



**TEST 10**  
**BENCH AND MACHINE TOOLS**

*Match the words on the left with their definitions on the right*

a) gear	1) a machine or part of a machine that does a particular job
b) wheel	2) a round part inside a machine that fits into another similar part and makes it turn around and around
c) benchgrinder	3) having a rough surface that can be used to rub and clean other surfaces
d) knurl	4) A small machine for grinding which, having short legs, is set on a bench to bring it to a convenient height.
e) carve	5) a machine used for making the surface of wood or metal smooth
f) lathe	6) to provide with ridges, to assist the grasp, as in the edge of a flat knob, or coin
g) pulley	7) to make an edge that can cut or an end that is pointed
h) rough	8) to make an object by cutting it from stone or wood
i) abrasive	9) a part of a machine that holds a moving p
j) sander	10) A powered vertical drilling machine in which the drill is pressed to the work automatically or by a hand lever.
k) sharpen	11) a machine that holds a piece of wood or metal and makes it move around so that you can cut and shape it evenly
l) bearing	12) a piece of equipment used for lifting something very heavy. It consists of one or more wheels, around which you pull a rope or chain that is fastened to the thing that you want to lift
m) drillpress	13) surface that is not smooth
n) rotate	14) a machine that carries things up and down
o) lift	15) to make something shine by rubbing it with something such as a soft cloth
p) buff	16) to move in a circle around a fixed central point

## GLOSSARY

**Aluminum** – a silver-white metallic element, light in weight, ductile, and not readily corroded, occurring combined in nature in igneous rock, clay, and most soil: used in alloys and for lightweight utensils, airplane parts, etc. Symbol: Al; atomic weight: 26.98; atomic number: 13; specific gravity: 2.70 at 20 C. Abbreviation: alum.. Ukrainian: алюміній

**Anneal** – to heat (glass, metals, etc.) to remove or prevent internal stress; to free from internal stress by heating and gradually cooling. Ukrainian: гартувати, обпалювати

**Anodize** – coat (a metal, especially aluminum) with a protective oxide layer by an electrolytic process in which the metal forms the anode. Ex. One of the most common metals that is anodized is aluminum. Ukrainian: анодувати

**Bauxite** – an amorphous clayey rock that is the chief commercial ore of aluminum. Ex. The principal economic activities and primary sources of foreign exchange are bauxite mining and alumina production. Ukrainian: боксит

**Brass** – a yellow alloy of copper and zinc. Ukrainian: латунь, латунний, металічний

**Brittleness** – (metallurgy) the tendency of a metal to break without being significantly distorted or exposed to a high level of stress. Ukrainian: крихкість

**Bronze** – a yellowish-brown alloy of copper with up to one-third tin. Ex. During the fifth century BC the Athenians introduced the third and more low currency metal: bronze, an alloy of copper and tin. Ukrainian: бронза

**Carbon** – 1) a widely distributed element that forms organic compounds in combination with hydrogen, oxygen, etc., and that occurs in a pure state as diamond and graphite. Symbol: C; atomic number: 6. 2) carbon dioxide or other carbon compounds that are emitted into the atmosphere and cause rising temperatures. Ex. The carbon produced by burning fossil fuels. Ukrainian: вуглець, вуглекислий газ

**Civil engineering** – is the planning, design, and building of roads, bridges, harbours, and public buildings. Ex. The Channel Tunnel project is the biggest civil engineering project in Europe. Ukrainian: цивільне будівництво

**Coal** – a combustible black or dark brown rock consisting chiefly of carbonized plant matter, found mainly in underground seams and used as fuel. Ex. Gas-fired electricity is cheaper than coal. Today, oil and natural gas have replaced coal and wood in most areas. Ukrainian: кам'яне вугілля

**Coke** – is a solid black substance that is produced from coal and is burned as a fuel. Used chiefly as a fuel in metallurgy to reduce metallic oxides to metals. Ukrainian: кокс

**Complicated projects** – If you say that something is complicated, you mean it has so many parts or aspects that it is difficult to understand or deal with. Ukrainian: складний (заплутаний) проект (план, програма)

**Composite materials** – materials, generally strong and lightweight, in which fibers of more than one sort of material are bonded together chemically.

These types of materials were developed in the laboratory and derive their strength from the combination of materials rather than from the interlocking of a uniform set of atoms.

**Conductor** – a material which contains movable electrical charges; a material or device that conducts or transmits heat, electricity, or sound, esp. when regarded in terms of its capacity to do this. Ex. Graphite is a reasonably good conductor of electricity. Ukrainian: провідник, диригент, провід, жила

**Construct** – build or make (something, typically a building, road, or machine). Ukrainian: будувати, споруджувати, зводити будівлю, конструювати

**Contribution** – a gift or payment to a common fund or collection. Ukrainian: сприяння, внесок, вклад (у науку, справу)

**Copper** – a red-brown metal, the chemical element of atomic number 29. (Symbol: Cu). Ex. Exports-ranging from soy, flowers, copper, and iron ore to computers, appliances, and jets – have boomed. Ukrainian: мідь

**Creep** – the gradual, permanent deformation of a body produced by a continued application of heat or stress.

**Cutter** – a tool for cutting something, especially one intended for cutting a particular thing or for producing a particular shape. Ukrainian: різець, фреза, різак

**Design** – a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is made. Ukrainian: 1) проект, план, конструкція. 2) малюнок, візерунок, узор, креслення, дизайн

**Develop** – to bring out the capabilities or possibilities; bring to a more advanced or effective state: Ex. To develop natural resources; to develop one's musical talent; to cause to grow or expand: to develop one's muscles. Ukrainian: розвивати(ся), конструювати, розробляти

**Ductility** – able to undergo change of form without breaking. Ukrainian: гнучкість, ковкість, тягучість, податливість, в'язкість, еластичність

**Elasticity** – the elasticity of a material or substance is its ability to return to its original shape, size, and condition after it has been stretched. Ukrainian: пружність

**Electrical engineering** – is the designing, constructing, and maintenance of electrical devices.

**Electroplate** – (electroplating) coat (a metal object) by electrolytic deposition with chromium, silver, or another metal. Ukrainian: гальванізувати, наносити шар металу гальванічним способом

**Engineering** – the action, work, or profession of an engineer. Ex. Like medicine, engineering is often the most prestigious vocation in developing countries.

**Engine lathe** – the “Engine Lathe” got its name from the development of the steam engine. This lathe was originally developed to machine engine blocks, it played a great role in the historical development of the steam engine. It was not called “Engine Lathe” before the steam engine was developed, only after and still till this day. Ukrainian: токарний двигун

**Ferrous metals** – ferrous metals and alloys contain iron; non-ferrous materials do not. Ferrous metals include mild steel, carbon steel, stainless steel, cast iron, and wrought iron. Ukrainian: чорні метали

**Ferrum** – n. Iron.

**Forecast** – predict (a future condition or occurrence), calculate in advance: Ex. Surfers today forecast waves using technology. Ukrainian: прогноз

**Forge** – 1) to form by heating and hammering; beat into shape. Ex. For a dark blade such as this, the metal is forged in a magical fire of burning ice. 2) a place in which metal is worked by heating and hammering. Ukrainian: кувати, кузня

**Galvanize** – galvanized coat (iron or steel) with a protective layer of zinc. Derivatives: galvanization, galvanizer. Ukrainian: гальванізувати, оцинковувати

**Gold** – a yellow precious metal, the chemical element of atomic number 79, used in jewellery and decoration and to guarantee the value of currencies. Ukrainian: золото, колір золота, золотистий колір

**Harden** – make or become hard or harder: Ex. wait for the glue to harden, bricks which seem to have been hardened by firing. Ukrainian: ставати твердим, тверднути, черствіти, загартовувати, зміцнювати, стабілізуватися (про ринок), цементувати

**Hardness** – when something hardens or when you harden it, it becomes stiff or firm. Ukrainian: твердість, щільність, цупкість, міцність, жорсткість

**Iron** – a strong, hard magnetic silvery-grey metal, the chemical element of atomic number 26, much used as a material for construction and manufacturing, especially in the form of steel. (Symbol: Fe). Ukrainian: залізо, чорний метал, виріб із заліза

**Liquid** – a substance that flows freely but is of constant volume, having a consistency like that of water or oil. Ukrainian: рідкий, рідина

**Limestone** – is a whitish-coloured rock which is used for building and for making cement. Ex. High limestone cliffs.... The local limestone is very porous. Marine limestones. Ukrainian: вапняк

**Manganese** – the chemical element of atomic number 25, a hard grey metal of the transition series. Manganese is an important component of special steels and magnetic alloys. (Symbol: Mn). Ex. The black dioxide of manganese as an industrial raw material or additive, especially in glass making. Ukrainian: марганець, манган

**Manufacturing processes** – make (something) on a large scale using machinery. Ukrainian: промисловий процес

**Metal alloy** – a metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion. Ukrainian: сплав (металів), домішка, лігатура, проба (дорогоцінного металу), легований; alloy steel – легована сталь, стоплювати, сплавляти (метали), підмішувати, домішувати (щось – with)

**Mechanical engineering** – the branch of engineering dealing with the design, construction, and use of machines. Derivatives: mechanical engineer.

**Metal processing** – perform a series of mechanical or chemical operations on (something) in order to change or preserve it. Ukrainian: обробка металів

**Mechanician** – a person skilled in the design or construction of machinery. Ukrainian: конструктор, машинобудівник, механік

**Memory** – the part of a computer in which data or program instructions can be stored for retrieval. Ex. Main memory – оперативна пам'ять (random access memory, RAM), read only memory, ROM – постійний запам'ятовувальний пристрій, постійна пам'ять. Ukrainian: пам'ять, комп'ютерна пам'ять (storage)

**Mercury** – a heavy metal of high luster is especially good conductor of heat and electricity. Ex. Mercury is classified as a “Transition Metal” which is located in Groups 3 – 12 of the Periodic Table. Known to the ancient Egyptians, Romans, Indians and Chinese. Mercury is one of the metals referred to as one of the “Metals of Antiquity”. The ancient “Metals of Antiquity” together with their approximate dates of discovery and use are Gold (6000BC), Copper (9000BC), Silver (4000BC), Lead (6400BC), Tin (3000BC), Iron (1500BC) and Mercury (1500BC). Ukrainian: ртуть, ртутний стовпчик

**Metallurgy** – the study of metals. It is a domain of materials science and engineering that studies the physical and chemical behaviour of metallic elements, their intermetallic compounds, and their mixtures, which are called alloys. Metallurgy is also the technology of metals: the way in which science is applied to the production of metals, and the engineering of metal components for usage in products for consumers and manufacturers. Ex. Metallurgy is distinguished from the craft of metalworking, although metalworking relies on metallurgy, as medicine relies on medical science, for technical advancement. Ukrainian: металургія

**Mild Steel** – steel which contains only a small percentage of carbon and is strong and easily worked but not readily tempered or hardened.

**Mill** – is the machining process of using rotary cutters to remove material from a workpiece by advancing or feeding in a direction at an angle with the axis of the tool. It is one of the most commonly used processes in industry and machine shops today for machining parts to precise sizes and shapes. Ukrainian: обробляти на верстаті, фрезерувати

**Milling machine** – a non portable power tool, such as a lathe or milling machine, used for cutting or shaping metal, wood, or other material. Ukrainian: фрезерний верстат

**Mine** – obtain coal or other minerals from a mine. Dig in the earth for coal or other minerals. Ex. The hills were mined for copper oxide. Many financiers obtained concessions to mine for silver. Dig or burrow in the earth. Exploit (a source of information or skill). Ex. How do they manage to mine such a rich vein of talent? Analyze a database to generate new information. Lay explosive mines on or just below the surface of the ground or water. Ex. The area was

heavily mined. Destroy by means of an explosive mine. Ukrainian: рудник, копальня, шахта, поклад, пласт, джерело знань, підкоп, змова, інтрига, міна.

**Mint** – often be minted make (a coin) by stamping metal; minted – produce for the first time. Ex. An example of newly minted technology. Ukrainian: карбувати (монети), створювати (нове слово, вислів), велика кількість (сума)

**Molybdenum** – the chemical element of atomic number 42, a brittle silver-grey metal of the transition series, used in some alloy steels. (Symbol: Mo). Ukrainian: молібден

**Nickel** – a silvery-white metal, the chemical element of atomic number 28. (Symbol: Ni). Ukrainian: нікель

**Nitrogen** – the chemical element of atomic number 7, a colourless, odourless unreactive gas that forms about 78 per cent of the earth's atmosphere. Liquid nitrogen (made by distilling liquid air) boils at 77.4 kelvins (-195.8°C) and is used as a coolant. (Symbol: N). Ukrainian: азот

**Non ferrous metals** – relating to or denoting a metal other than iron or steel. Ukrainian: кольоровий (про метал)

**Ore** – a naturally occurring solid material from which a metal or valuable mineral can be extracted profitably. Ukrainian: руда, ore mining – гірничорудна справа

**Plastic polymer** – a substance which has a molecular structure built up chiefly or completely from a large number of similar units bonded together, e.g. many synthetic organic materials used as plastics and resins. Ukrainian: пластичний полімер

**Plate** – a thin, flat sheet or strip of metal or other material, typically one used to join or strengthen things or forming part of a machine . Ukrainian: плита, лист, штаба (металу), листове залізо розковувати в листи, плющити (метал)

**Platinum** – the rarest element in the Earth's crust, it is the least reactive metal; corrosive resistant; most often used in catalytic converters, medical and dental equipment, and jewelry. The atomic number of this element is 78. (Symbol: Pt). Platinum was discovered by astronomers Antonio de Ulloa and Don Jorge Juan y Santacilia in 1735. Ex. Platinum has the ability to to conduct electricity. Platinum together with rhodium, ruthenium, palladium, osmium and iridium form a group of elements referred as the platinum group metals (PGM). Ukrainian: платина

**Properties of the steel** – an attribute, quality, or characteristic of something. Ex. The property of heat to expand metal at uniform rates. Ukrainian: властивість, якість (сталі)

**Provide** – if you provide something that someone needs or wants, or if you provide them with it, you give it to them or make it available to them. Ex. I'll be glad to provide a copy of this. They would not provide any details. The government was not in a position to provide them with food. Syn: supply. Ukrainian: постачати, забезпечувати, надавати, наділяти, постановляти, ухвалювати, обумовлювати, ставити за умову, вживати (заходи), забороняти, передбача-

ти, формулювати, встановлювати (в законі, нормі загального права тощо)

**Research** – the systematic investigation into and study of materials and sources in order to establish facts and reach. Ex. New conclusions the group carries out research in geochemistry. He prefaces his study with a useful summary of his own researches. Engaged in or intended for research. Ex. a research student, a research paper. Ukrainian: наукове дослідження, вивчення, дослідницька робота, ретельні пошуки (after, for), дослідницький; research work – науково-дослідна робота, досліджувати, займатися дослідженнями (into)

**Resilience** – demanding great ability, skill. Ex. Do you feel that your muscles do not have the strength and resilience that they should have? Ukrainian: пружність, еластичність, здатність швидко відновлювати фізичні та душевні сили, пружна деформація

**Scientific approach** – approach based on or characterized by principles of science. Ex. Aristotle took the scientific approach a step further.

**Scientist** – a person who is studying or has expert knowledge of one or more of the natural or physical sciences. Ukrainian: науковець

**Silver** – a precious shiny greyish-white metal, the chemical element of atomic number 47. (Symbol: Ag). Ukrainian: срібло, срібні гроші, срібні вироби, table silver – столове срібло, колір срібла, срібний, сріблястий, silver sand – дрібний білий пісок

**Slag** – stony waste matter separated from metals during the smelting or refining of ore. Ex. Similar material produced by a volcano, scoria. Ukrainian: шлак, окалина

**Solid** – firm and stable in shape; not liquid or fluid. Ukrainian: тверде тіло

**Specific strength** – the specific strength is a material's strength (force per unit area at failure) divided by its density. It is also known as the strength-to-weight ratio or strength/weight ratio. Ukrainian: питома міцність

**Specific weight** – the specific weight (also known as the unit weight) is the weight per unit volume of a material. The symbol of specific weight is  $\gamma$  (the Greek letter Gamma). Ukrainian: питома вага

**Stainless Steel** – a form of steel containing chromium, resistant to tarnishing and rust. Any of various alloys of iron that contain chromium, nickel, and small amounts of carbon. They may also contain minor amounts of other elements, such as molybdenum. Stainless steel is resistant to rusting and corrosion. Ex. a stainless steel sink.

**Steel** – a hard, strong grey or bluish-grey alloy of iron with carbon and usually other elements, used as a structural and fabricating material. Ukrainian: сталь, криця, сталевий бур, сталевий, жорстокий, вкривати сталлю, загартовувати

**Stiffness** – not easily bent or changed in shape; rigid. Ukrainian: жорсткість. Syn. inelasticity, inflexibility, rigidity.

**Strain** – a force tending to pull or stretch something to an extreme or damaging degree. Ex. The usual type of chair puts an enormous strain on the spine. Aluminum may bend under strain. In physics strain is the magnitude of a defor-

mation, equal to the change in the dimension of a deformed object divided by its original dimension. Ukrainian: згинати, скручувати, деформувати, натягання, розтягування. Ex. The rope broke under the strain – мотузка не витримала натягання. Word combinations: *strain after* – прагнути до чогось; *strain at* – натягати (тягти) з усіх сил; *strain off* – відщіджувати

**Strength** – strength of materials. Ukrainian: опір матеріалів, неприступність, міцність

**Temper** – the degree of hardness and elasticity in steel or other metal. Ukrainian: вміст вуглецю, ступінь твердості та пружності, робити суміш, змішувати

**Tin** – a corrosion-resistant, malleable metal used in many alloys, as well as to coat other metals for corrosion resistance; most commonly used to package food products. Ukrainian: олово, жерсть

**Tinplate** – sheet steel or iron coated with tin. Ukrainian: (біла) жерсть

**Titanium** – is a light strong white metal. Ukrainian: титан

**To insulate** – protect (something) by interposing material that prevents the loss of heat or the intrusion of sound. Ukrainian: ізолювати

**Toughness** – Ukrainian: в'язкість. Syn. viscosity – загартованість. Syn. hardness, fitness – міцність. Syn. durability, stability, firmness.

**Tungsten** – the chemical element of atomic number 74, a hard steel-grey metal of the transition series. It has a very high melting point (3410°C) and is used to make electric light filaments. (Symbol: W). Origin: late 18th cent.: from Swedish, from tung “heavy” + sten “stone”. Ukrainian: вольфрам

**University graduates** – a person who has successfully completed a course of study or training, especially a person who has been awarded an undergraduate or first academic degree. Ukrainian: той, що має науковий ступінь, що закінчив навчальний заклад

**Vanadium steel** – a strong alloy of steel containing vanadium.

**Waste** – use or expend carelessly, extravagantly, or to no purpose of a material, substance, or byproduct, eliminated or discarded as no longer useful or required after the completion of a process. Ex. Ensure that waste materials are disposed of responsibly. Plants produce oxygen as a waste product. Ukrainian: непридатний, бракований, спрацьований

**Weight** – a body's relative mass or the quantity of matter contained by it, giving rise to a downward force; the heaviness of a person or thing. A unit or system of units used for expressing how much an object or quantity of matter weighs. Ex. weights and measures. Ukrainian: вага, маса



## APPENDIX LIST OF ABBREVIATIONS

- a. c.** [alternating current] – змінний ток
- amp.** – [ampere] – ампер
- B. D. C.** [bottom dead centre] – нижня мертва точка
- b. h. p.** [brake horsepower] – ефективна гальмівна сила
- C** – centigrade – за стоградусною шкалою Цельсія (про температуру)
- c. c./cu. cm.** [cubic centimetre] – кубічний сантиметр
- cu. ft.** [cubic foot] – кубічний фут
- cu. in.** [cubic inch] – кубічний дюйм
- d. c.** [direct current] – постійний ток
- e. g.** – *exempli gratia* (лат.) – наприклад
- etc.** – *et cetera* (лат.) – т. ін.
- F.** [Fahrenheit] – по шкалі Фаренгейта (про температуру)
- f. p. m.** [feet per minute] – футов за хвилину
- f. p. s.** [feet per second] – футов в секунду
- ft.-lbs.** [foot-pounds] – футо-фунти
- g. p. m.** [gallon per minute] – галлон в хвилину
- gal.** [gallon] – галлон
- hp** [horsepower] – кінська сила
- hr.** – hour – година
- i. e.** – *id est* (лат.) – тобто
- in.** [inch] – дюйм
- k. p. h.** [kilometers per hour] – кілометрів за годину
- kg.** – kilogram – кілограм
- L** – litre – літр
- lb** [pound] – фунт
- lb.-ft.** [pound-foot] – фунто-фут
- m.** – metre – метр
- m. p. h.** [miles per hour] – миль за годину
- mi.** – mile – миля

**min.** – minute – хвилина

**NB** – nota-bene (лат.) – pay attention – зверніть увагу

**n. h. p.** [nominal horsepower] – номінальна кінська сила

**n. t. p.** [normal temperature and pressure] – нормальні температура і тиск

**o. a. d.** [overall dimension] – габаритний розмір

**psi.** [pounds per square inch] – фунти на кв. дюйм

**r. p. m.** [revolutions per minute] – обертів у хвилину

**s.** – second – секунда

**sq. ft.** [square foot] – квадратний фут

**t.** – ton – тонна

**t. d. c.** [top dead centre] – верхня мертва точка

**v.** [velocity] – швидкість

**vol.** [volume] – об'єм

**vs** – versus (лат.) – проти

**w.** – watt – ват

**wt.** [hundredweight] – центнер

**X-rays** – Roentgen rays – рентгенівські промені

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