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ENGLISH FOR ENGINEERS

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Учебное пособие предназначено для студентов 2-го курса (3-го семестра) АВТФ, ФПМИ, ФЛА, МТФ, ФТФ, РЭФ для использования на занятиях в рамках дисциплины «Иностранный язык».

Целью пособия является формирование у студентов коммуникативной языковой компетенции в области своей специальности, которая реализуется в различных видах речевой деятельности, как устной, так и письменной. Учебное пособие включает 3 раздела: “Fundamentals of Engineering” (“Основы инженерного дела”), “Training Future Engineers” (“Подготовка будущих инженеров”), “English for Specific Purposes” (“Английский для специальных целей”). В пособии представлен аутентичный текстовый, аудио- и видеоматериал общенаучного и технического характера для аудиторной и самостоятельной работы.

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Module I. FUNDAMENTALS OF ENGINEERING

Unit 1. What is Engineering. Engineering Profession

TEXT 1

Vocabulary

1. ancient times – древние времена
2. pulley, *n* – шкив
3. lever, *n* – рычаг
4. wheel, *n* – колесо
5. innate, *adj.* – врожденный
6. recent, *adj.* – недавний
7. derive from, *v* – происходить от
8. origin, *n* – происхождение
9. aqueduct, *n* – акведук
10. ultimately, *adv.* – в конце концов
11. hence, *adv.* – следовательно
12. testament, *n* – завещание
13. ingenuity, *n* – изобретательность
14. pump, *n* - насос
15. narrowly, *adv.* – узко
16. accelerate, *v* – ускорять

1. Work in pairs. Discuss the following questions. Then share your opinion with the rest of the group.

1. Do you know anything about the origin of the word “engineering”?
2. What are the earliest most important engineering inventions?
3. When did the first engineers appear?

2. Practice pronunciation of the following words and remember them. The stressed part is in bold type.

Engin**ee**ring, inv**e**ntion, p**u**lley, wh**ee**l, c**i**vil, mech**a**nical, **e**ngine, d**i**sci-pline, electr**i**city, ind**u**strial, revol**u**tion, v**a**cuum, acceler**a**te, special**i**zed, ch**e**mical, w**ei**ght, **e**nergy, t**o**rque, constr**u**ction, f**ur**ther, dev**e**lopment, des**i**gn.

3. Read the text.

History

The *concept* of engineering has existed since ancient times as humans devised fundamental inventions such as the pulley, lever, and wheel.

The term engineering itself has a much more recent etymology, deriving from the word engineer, which itself dates back to 1325, when an engine'er originally referred to a constructor of military engines.

The word "engine" itself is of even older origin, ultimately deriving from the Latin *ingenium* (c. 1250), meaning "innate quality, especially mental power, hence a clever invention."

Ancient Era

The Acropolis and the Parthenon in Greece, the Roman aqueducts, the Colosseum, the Hanging Gardens of Babylon, the Pharos of Alexandria, the pyramids in Egypt, Inca and Aztec Empires, the Great Wall of China, among many others, stand as a testament to the ingenuity and skill of the ancient civil and military engineers.

The earliest civil engineer known by name is Imhotep. He probably designed and supervised the construction of the Step Pyramid in Egypt around 2630-2611 BC. He may also have been responsible for the first known use of columns in architecture.

Ancient Greece developed machines in both in the civilian and military domains. The mechanical inventions of Archimedes are examples of early mechanical engineering.

Middle Era

An Iraqi by the name of al-Jazari influenced the design of today's modern machines when at the end of the 12th centure he built machines to pump water for some Turkish palaces. They were instrumental in the later development of engineering in general.

Renaissance Era

The first electrical engineer is considered to be William Gilbert, with his publication of De Magnete (1600). He was the originator of the term "electricity".

The first steam engine was built in 1698 by mechanical engineer Thomas Savery. The development of this device gave rise to the industrial revolution, allowing to begin mass production.

With the rise of engineering as a profession in the eighteenth century, the term became more narrowly applied to fields in which mathematics and science were extremely important.

Modern Era

Electrical Engineering appeared due to the experiments of A. Volta, M.Faraday, G. Ohm and others and the invention of the electric motor in 1872. The work of James Maxwell and Heinrich Hertz in the late 19th century gave rise to the field of Electronics. The later inventions of the vacuum tube and the transistor further accelerated the development of Electronics.

The inventions of T. Savery and the Scottish engineer J. Watt gave rise to modern Mechanical Engineering. The development of specialized machines during the industrial revolution led to the rapid growth of Mechanical Engineering both in Britain and abroad.

Industrial scale manufacturing demanded new materials and new processes. So by 1880 the need for large scale production of chemicals was so great that a new industry was created. It is called now Chemical Engineering.

Aeronautical Engineering deals with aircraft design while Aerospace Engineering is a more modern term including spacecraft design. Its origins can be traced back to the aviation pioneers around the turn of the century from the last decade of the 18th century to the 20^{th}. Early knowledge of aeronautical engineering was largely empirical. Only a decade after the successful flights by the Wright brothers, the 1920s saw extensive development of aeronautical engineering through development of World War I military aircraft. Theoretical physics with experiments contributed a lot to its development.

Engineers have historically been of great significance to any society, and that trend is only likely to increase over time. As our world becomes rapidly more technology dependent, the reliance on good tech will make Engineers highly important.

4. The following words are all from the text above. Find them in the text:

civilian decade automotive require abroad

5. For each word read the sentence it occurs in and answer the questions:

a) Is the word positive, negative or neutral?

b) Is it a noun, adjective, adverb or verb?

c) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

6. Answer the questions:

1. What does the word “engine” mean?
2. What year does it date back to?
3. Can you name the examples of the ancient civil and military engineers?
4. Who is the first earliest civil engineer? What did he design?
5. Who influenced the design of today's modern machines in the Middle Era?
6. What engineers is Renaissance Era famous for?
7. Who was the originator of the term “electricity”?
8. How did the first steam engine influence the industrial revolution?
9. When was the rise of engineering as a profession?
10. Who carried out experiments with electricity?
11. Who contributed to the development of modern Mechanical Engineering?
12. What period is characterized by extensive development of aeronautical engineering?

7. Complete the sentences:

1. The *concept* of engineering has existed since ancient times…
2. Imhotep probably designed and supervised the construction of…
3. The mechanical inventions of Archimedes are…
4. Some of Archimedes’ inventions…, as well as two key principles in machine theory.
5. An Iraqi influenced the design of…
6. William Gilbert was the originator of …
7. The first steam engine … by mechanical engineer Thomas Savery.
8. Electrical Engineering appeared due to…
9. The development of specialized machines during the industrial revolution led to…

10. So by 1880 the need for chemicals…

11. Early knowledge of …largely empirical.

12. Only a decade after…, the 1920s saw extensive development of aeronautical engineering

8. Match the words and expressions on the left with those on the right:

1) maintenance tool	a) быстрый рост
2) military project	b) за границей
3) date back	c) прибор, устройство
4) specialized machine	d) строения невоенного назначения
5) rapid growth	e) массовое производство
6) civilian structures	f) специализированный станок
7) mass production	g) область, сфера
8) field	h) военный проект
9) abroad	i) датироваться
10) device	j) эксплуатационный инструмент

9. Match the terms in the box with the definitions below:

Electric motor bridge electronics steam engine vacuum tube wheel software engineer lever invention search engine electronics

1. service on the Internet enabling users to search for items of interest.

2. a device that converts electrical energy to mechanical torque.

3. electron tube containing a cathode, anode, and, usually, one or more additional control electrodes.

4. a structure that gives a passage over a road, railway, river, etc.

5. the discovery or production of some new or improved process or machine

6. a person who writes computer programs

7. a heat engine that performs mechanical work using steam as its working fluid

8. one of the round objects under a car, bicycle, bus, etc. that turns when it moves

9. the branch of science and technology that studies electric currents in electronic equipment

10. a handle used to operate a vehicle or a machine

10. Try to explain one of the terms from exercise 8 and ask your groupmates to guess it.

11. Give the English equivalents of the following words and word combinations:

1. с древних времен
2. происходит от латинского языка
3. Колизей
4. висячие сады Вавилона
5. быть ответственным за что-л.
6. перекачивать воду
7. положить начало
8. появиться благодаря чему-либо
9. привести к быстрому росту
10. спрос
11. проследить
12. значительное развитие
13. привнести вклад
14. тенденция

12. Translate into English:

1. Шесть классических простых машин были известны еще в древнем Ближнем Востоке.

2. Клин и наклонная плоскость (пандус) были известны с доисторических времен.

3. Колесо было изобретено в Месопотамии (современный Ирак) в 5-м тысячелетии до нашей эры.

4. Рычажный механизм появился впервые на Ближнем Востоке около 5000 лет назад.

5. Этот механизм использовался в простых балансовых весах, а также для перемещения крупных объектов в древнеегипетской технике.

6. Древняя Греция разрабатывала машины как в гражданской, так и в военной сферах.

7. Самая первая практическая паровая машина была описана в 1551 году в Османском Египте.

8. Самые ранние программируемые машины были разработаны в мусульманском мире.

9. Музыкальный секвенсор (музыкальный инструмент) был самой первой программируемой машиной.

10. Первая поисковая система была создана инженером Аланом Эмтадж в 1990 году.

13. Speak about engineering principles and the main qualities of an engineer. Use the following questions as a plan:

1. What is Engineering?
2. What sciences is Engineering principally based on?
3. What knowledge does Engineering apply to realize a desired objective?
4. What does the word “engineer” mean?
5. What qualities should an engineer have?
6. Why must every detail be reviewed thoroughly during engineering work?
7. Why is it necessary for an engineer to have excellent communication skills?
8. How does creativity help an engineer?
9. Is it important for an engineer to think logically?
10. Should an engineer be a Team Player? Why/Why not?
11. Why do engineers have to keep on learning all their lives?
12. What are the crucial tasks of an engineer?
13. What are the crucial skills to hone for the rising engineer?
14. What is important in engineering in order to produce a successful product?

TEXT 2

Vocabulary

1. imagination, *n* – воображение
2. importance, *n* – важность
3. marvel, *n* – чудо
4. assembly lines – сборочная линия
5. application, *n* – приложение

6. contribute, *v* – способствовать
7. sustenance, *n* – поддержка
8. enable to do smth. – предоставить возможность, позволить
9. sustainable means – стабильные, жизнеспособные способы
10. to effectively handle – эффективно решать
11. traffic congestions – дорожные пробки
12. contaminate, *v* – загрязнять
13. tackle the issues – решить вопросы, проблемы

1. Answer the following questions:

1. What is Engineering? What are the tasks of Engineering?
2. Can you name the main engineering sectors?
3. What sciences do engineers apply to develop solutions to the world's issues?

2. Match the following words (1, 2, 3) and their definitions (a, b, c):

1) Engine
2) Engineer
3) Engineering

a) practical application of scientific knowledge in the design, construction and control of machines
b) a machine with moving parts that produces energy (heat, electricity)
c) a person who designs, builds, maintains engines, bridges, buildings, etc …

3. Read the text "Why Engineering is Important in the Present Day":

For ages, engineering has turned imagination and fantasy into something that is tangible and useful. For instance, consider the invention of the wheel as one of the oldest examples of how engineering has transformed our lives. Since the dawn of the industrial age, the importance and influence of Engineering has grown at a blazing speed.

The modern world we live in wouldn't have been possible without the marvels of engineering – microprocessors, high-speed motors, cellular networks, power grids, automated assembly lines and many others. It wouldn't be too far-fetched to claim that without engineering, our society would have ossified in no time.

Today, the application of engineering spans the spectrum from deep sea exploration to space travel and beyond. In the modern era, it would be extremely difficult to find an avenue where engineering hasn't left its footprint. From construction to aeronautics, medicine to environment, and even the chair you are sitting in, engineering is everywhere!

Let's take a look at how engineering has contributed to various sectors:

1. *Construction*

Without Civil engineers, the Hoover Dam, the Burj Khalifa or the Chenab Bridge would have been a distant reality. Engineering has contributed immensely towards the development of infrastructure that is crucial to the sustenance of our civilization. Proper knowledge of civil engineering has not only enabled us to build bridges, dams, tunnels, expressways but also figure out a way to effectively handle traffic congestions, disasters, and other unfavorable circumstances.

2. *Medicine*

When we talk about the progress in medical science, the image of a biologist or a highly-qualified doctor comes to our mind. But, you will be surprised to know that engineering and medical science goes hand in hand with each other to improve the quality of healthcare. From MRI machines to X-rays and pacemakers to Glucose Level Monitors - engineering has contributed more to medical science than we can fathom.

3. *Energy*

Have you ever wondered about the technology that powers small household appliances to humongous machines in factories? Of course, it's the electric current that is conducted by high-tension wires from power stations. But, how are the grids designed? Or, how do you ensure that high-voltage current doesn't damage your gadgets? Well, you have electric engineers to thank for that. Electrical engineering is helping us generate a massive amount of energy by designing and developing power grids, transformers, commutators, etc. Over the last decade, power generation through sustainable means such as solar and wind energy have been made possible due to the advancements in electrical and other engineering and technology.

4. *Environment*

Development and deployment of systems that provide drinking water, that is safe for human consumption is one of the major contributions

of environmental engineering. Moreover, we also need a mechanism that can reduce pollution and clean up contaminated water bodies, land, and sustain our crops and livestock. Thankfully, the pioneers in environmental engineering are tackling these issues by coming up with new and innovative solutions to minimize pollution making our industrial processes environment-friendly.

Apart from these areas, Engineering has a wide range of applications in automotive, food processing, manufacturing, electronics, avionics, biotechnology, and software industries.

The world is changing, and engineers are the ones behind so much of this development. The majority of today's services and products had some element of engineering.

In an advanced technological world, we need engineers to bring ideas into reality. By applying the principles of mathematics and science, engineers develop solutions to the world's biggest technical issues.

4. The following words are all from the text above. Find them in the text:

immensely marvel contaminate tackle major

5. For each word read the sentence it occurs in and answer the questions:

d) Is the word positive, negative or neutral?

e) Is it a noun, adjective, adverb or verb?

f) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

6. Answer the questions:

1. What is one of the oldest engineering inventions which transformed our life?
2. When did the importance of engineering begin to grow?
3. Can you name some modern engineering marvels?
4. What is the application of engineering?
5. In what way does knowledge of civil engineering help people?
6. What is another science that engineering goes hand in hand with to improve the quality of healthcare?
7. What engineering branch is helping us generate a massive amount of energy by designing and developing power grids?
8. Can you name any sustainable means to generate power?

9. What is one of the major contributions of environmental engineering?
10. Who is dealing with problems to minimize pollution?
11. What other industries does engineering encompass?
12. Why do we need engineers in our technological world?

7. Complete the sentences:

1. Since the dawn of the industrial age,…
2. In the modern era, it would be extremely…
3. Engineering has contributed immensely towards…
4. Proper knowledge of civil engineering has not only enabled us…
5. …the image of a biologist or a highly-qualified doctor comes to our mind.
6. From MRI machines to X-rays and pacemakers to Glucose Level Monitors…
7. Of course, it's the electric current that is…
8. Electrical engineering is helping us generate…
9. Moreover, we also need a mechanism that…
10. Thankfully, the pioneers in environmental engineering are tackling…
11. Apart from these areas,…
12. …engineers develop solutions to the world's biggest technical issues.

8. Match the following words and their definitions:

1. engineering	a) to be in contact with somebody by using different methods of sending information (telephone, radio, voice, gestures, body language, etc …). A well-organized and careful way of doing something
2. solution	b) a person who designs, builds, maintains engines, bridges, buildings, etc …
3. to manufacture	c) to study the facts and then form an opinion about something.
4. engineer	d) a way of finding the answer to a problem or dealing with difficult situation.
5. to communicate	e) a well-organized and careful way of doing something.
6. methodical	f) a machine with moving parts that produces energy (heat, electricity).

7. define	g) to invent, plan and develop something for a particular purpose.
8. to evaluate	h) to make something in large quantities using machines.
9. to design	i) practical application of scientific knowledge in the design, construction and control of machines.
10. engine	j) to describe or show the nature or range of somebody/something

9. Order the steps of solving problems:

a) evaluate the solution
b) define the problem
c) communicate the solution
d) design a solution
e) test the solution

What do we call this way of solving problems?

10. Translate the following sentences into Russian. Translate the idea, not word for word:

1. These goods are made at our manufacture.
2. Where is the manufacture situated?
3. We don't like the quality of these goods, send them back to the manufacturer.
4. The case is very important for us, so we should find a practical solution immediately.
5. Was it difficult to find a good solution?
6. This good is a reasonable price and quality.
7. Your practical solution is quite reasonable.
8. You have designed a reasonable solution.
9. Engineers solve problems in a methodical way.
10. This means there are several steps in the problem-solving process.
11. At first you should clearly define a problem.
12. It's not sometimes easy to define a problem.
13. Different people design different solutions to one and the same problem.
14. Are you sure we should test the solution?

15. The solution was tested and turned to be a bad one.
16. I don't like the way you evaluate the situation.
17. You should be more careful when you try to evaluate something.
18. These goods were produced with the help of modern techniques.
19. The problem-solving process technique includes 5 steps.
20. You need to check up the engine.

11. Read the following text and fill in the gaps with suitable words from the box:

manufacturer process communicate test theoretical engineer produce methodical daily design engineering practical (x2) engineers define reasonable evaluate

What is Engineering? Practically everything we use in our modern life is made by (1) _____ . If a (2) _____wants to upgrade something, they ask a design (3) _____ to find a (4) _____ solution. (5) _____ is both (6) _____ and (7) _____ . Scientific knowledge is used to (8) _____ practical answers. A good design solution must be a (9) _____ price, not dangerous and reliable. Usually problems are solved in a (10) _____ way. There are 5 steps in the problem-solving (11) _____ : – (12) _____ the problem, – (13) _____ a solution, – (14) _____ the solution, – (15) _____ the solution, – (16) _____ the solution. This method is very useful and can be used in our (17) _____ life.

12. Give the English equivalents of the following words and word combinations:

1. с начала индустриального века
2. привнести огромный вклад
3. основательные знания гражданского инженерного дела
4. улучшить качество здравоохранения
5. провода высокого напряжения
6. электростанция
7. огромное количество энергии
8. проектирование и развитие электросетей
9. за последние десятилетия

10. благодаря достижениям
11. сохранить урожай и домашний скот
12. быть экологичным
13. большинство современных услуг
14. применять принципы математики

13. Translate into English:

1. Так почему инженеры становятся все важнее? Потому что почти все вокруг нас не существовало бы без них.

2. Основной принцип инженерной мысли всегда сводился к решению сложных проблем и к тому, чтобы сделать нашу жизнь простой, безопасной, счастливой и продуктивной.

3. Если мы взглянем на страницы истории, то увидим, что инженерия на протяжении тысячелетий решала сложные задачи.

4. Будь то транспорт, производство или даже победа в войнах, инженерия всегда играла ключевую роль в наших начинаниях.

5. Также и сегодня инженерия помогает создавать нам устройства, машины и программное обеспечение, которые могут решить некоторые из самых сложных проблем.

6. Например, инженеры в области робототехники разработали роботов, которые могут обнаруживать и обезвреживать взрывчатые вещества.

7. Также разработаны роботы для эвакуации жертв во время пожаров и стихийных бедствий.

8. Эти системы проходят тщательное тестирование и постоянно совершенствуются, прежде чем их начинают применять в больших масштабах.

9. Инженеры и ученые вместе работают над созданием экологически чистых технологий, недорогих ядерных реакторов и средств использования солнечной энергии.

10. Эти инновации помогают уменьшать количество загрязнения в нашей экосистеме.

14. Speak about the connections between science and engineering. If necessary, look up the Internet. Use the following questions as a plan:

1. Why did you choose to become an engineer?

2. What do engineers do in their career?
3. Is there any difference between an engineer and a scientist?
4. What is the goal of a scientist?
5. What is the goal of an engineer?
6. Are scientists dependent on engineers? Why/why not?
7. Who are masters of technology and who are inventors of technology?
8. What is the way that connects engineering and science?
9. What is common about engineering and science?
10. When may an engineer become a scientist?
11. What is the main difference between engineering research and scientific research?
12. Einstein had once said “Scientists investigate that which already is, Engineers create what there has never been”. Do you agree with the quotation? Why/why not?

TEXT 3

Vocabulary

1. PDA (personal digital assistant) – КПК (карманный персональный компьютер)
2. deal with, *v* – иметь дело с
3. involve, *v* – вовлекать, включать
4. construction, *n* – строительство
5. maintenance, *n* – монтаж, обслуживание
6. dam, *n* – дамба
7. operate, *v* – работать, функционировать, управлять
8. vehicle, *n* – транспортное средство
9. watercraft, *n* – судно
10. power grid – электрическая сеть

1. Before you read: match these captions with the pictures a–d.

1) Structures and vehicles of all sizes...
2) The Twin Towers, designed by Thornton-Tomasetti and Ranhill Bersekutu engineers were the world's tallest buildings from 1998 to 2004.
3) Electrical Engineers design complex power systems...
4) Personal digital assistant

a

b

c

d

2. There are some main branches of engineering. Look at the photographs with different areas of engineering in exercise 1 and match them with parts 1–4 below:

1. This engineering branch deals with the design of computers and computer systems. This may involve the design of new hardware, the design of PDAs and the use of computers to control an industrial plant. Engineers may also work on a software system.

2. This branch focuses on the design, construction and maintenance of the physical and naturally built environment, including works such as bridges, roads, canals, dams and buildings.

3. In this field engineers design, test, build and operate machinery of all types; they also work on a variety of manufactured goods and certain kinds of structure. Engineers use the main principles of mechanics, kinematics,

thermodynamics and energy to design and analyze motor vehicles, aircraft, heating and cooling systems, watercraft, industrial equipment and machinery, robotics, medical devices and more.

4. This branch of engineering deals with the generation, transmission and distribution of electricity. Engineers work with such devices as transformers, electric generators, electric motors, high voltage engineering and power electronics. In many regions of the world, governments maintain an electrical network called a power grid that connects a variety of generators together with users of their energy.

3. There are some words which you can guess from the context. Look at them. Are they nouns, verbs or adjectives?

Engineering, deal with, machinery, design, maintenance, transmission, building, generator, include, industrial, variety, user, range, aircraft

4. Refer back to the text and discuss the questions:

1. What engineering branches have you read about?
2. What are their peculiarities

5. Write a list of as many branches of engineering as you can think of. Compare your list with your groupmates' ones.

6. Read the text below and complete the blanks in the diagram:

Engineering is the discipline and profession of applying technical and scientific knowledge and using natural laws and physical resources in order to design and implement materials, structures, machines, devices, systems, and processes.

Historically the main branches of engineering are categorized as follows: civil engineering, mechanical and electrical engineering and electronics.

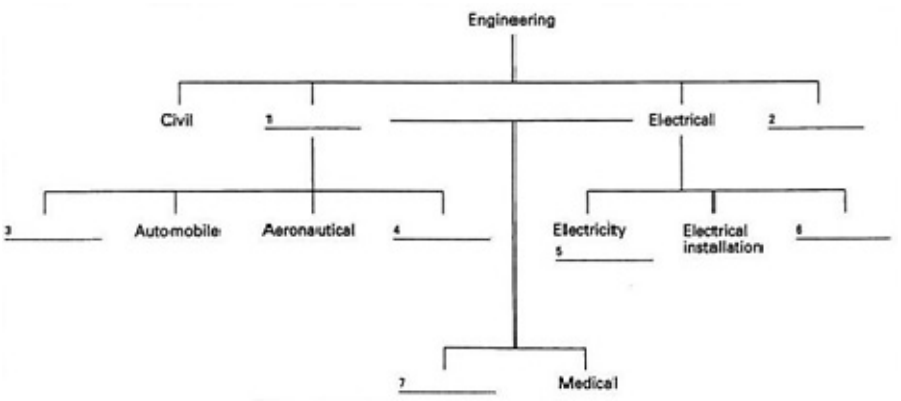
Mechanical engineering includes marine, automobile, aeronautical, heating and ventilating, and others. It deals with the design of physical and mechanical systems, such as engines, power trains, kinematic chains, vibration isolation equipment. This field is divided into machinery, mechanisms, materials, hydraulics, and pneumatics.

Electrical engineering is about the generation and distribution of electricity, electrical installation, lighting, etc. It is also concerned with the development and design, application, and manufacture of systems and devices that use electric power and signals.

Mining and medical engineering belong partly to mechanical and partly to electrical.

There is also communications and control engineering. These engineers work on control systems ranging from the everyday, passenger-actuated, such as those that run a lift, to the exotic, such as systems for keeping spacecraft on course. Control systems are used extensively in aircraft and ships, in military fire-control systems, in power transmission and distribution, in automated manufacturing, and in robotics.

Safety engineering is a field which prevents accidents. Safety engineers develop methods and procedures to safeguard workers in hazardous occupations. Engineering is a key driver of human development. In a modem world it is a well-respected profession.



7. Underline any engineering fields that are not in your list.

8. Answer the questions:

1. What is engineering? What is the function of this special field?
2. What branches of engineering do you know? Try to describe each of them.
3. Which engineering branch is concerned with making bridges, roads, airports, etc.?
4. Which branch is divided into machinery, mechanisms, materials, hydraulics, and pneumatics?
5. Which branches belong both to mechanical and electrical engineering?

6. What do engineers do working in control engineering?
7. What kind of methods and procedures do safety engineers develop?
8. Can you name the most important engineering branch?
9. Engineering is a respected profession, isn't it? Why/why not?
10. Why did you choose your specialty? What branch does it belong to?

9. Which branch of engineering is concerned with machines? With electricity? Study the examples:

1. Mechanical engineering ***deals*** *with* machines.
2. Mechanical engineers ***deal with*** machines.
3. Mechanical engineering ***is concerned with*** machines.
4. Mechanical engineers ***are concerned with*** machines.
5. Machines ***are the concern of*** mechanical engineers.

10. Now use these structures in the sentences of your own about the things from the list below and branches of engineering that deal with them.

air-conditioning	ships
roads and bridges	planes
body scanners	cars and trucks
cables and switchgear	power stations
communications equipment	

11. Using the information you've learnt about the engineering profession and brances of engineering, make a monologue on the topic "My Branch of Engineering".

Unit 2. ENGINEERING MATERIALS

Vocabulary

1. Tool, *n* – инструмент, станок, резец
2. Property, *n* – свойство
3. Ferrous metal – черный металл
4. Non-ferrous metal – цветной металл
5. Alloy, *n* – сплав
6. Copper, *n* – медь
7. Tin, *n* – олово
8. Brass, *n* – латунь
9. Insulator, *n* – изолятор
10. Ductile, *adj.* – ковкий, вязкий
11. Malleable, *adj.* – пластичный
12. Tough, *adj.* – твердый
13. Scratch-resistant, *adj.* – стойкий против механического контактного повреждения
14. Conductive, *adj.* – способный проводить (например, ток)
15. Durable, *adj*. – устойчивый
16. Stiff, *adj.* – тугой, неэластичный
17. Brittle, *adj.* – хрупкий
18. Corrosion-resistant – устойчивый к воздействию коррозии
19. Heat-resistant – устойчивый к высоким температурам
20. Chemical-resistant – химически устойчивый
21. Mild steel – мягкая сталь, малоуглеродистая сталь
22. High carbon steel – твердая сталь, высокоуглеродистая сталь
23. Harden, *v* – повышать твердость
24. Temper, *v* – закалять
25. Epoxy resin – эпоксидная смола
26. Wear resistance – износостойкость
27. Polyester resin – полиэфирная смола
28. Urea formaldehyde – мочевинный формальдегид

1. Answer the following questions.

1. What comes to your mind when you hear the word combination “engineering materials”?
2. What engineering materials do you know? What properties do they have?
3. What things are these materials used to produce?

2. Look at the pictures. What are these objects made of? What properties do these materials have?

3. Read and translate the text about engineering materials.

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

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

4. Read the text again and match the words with their definitions.

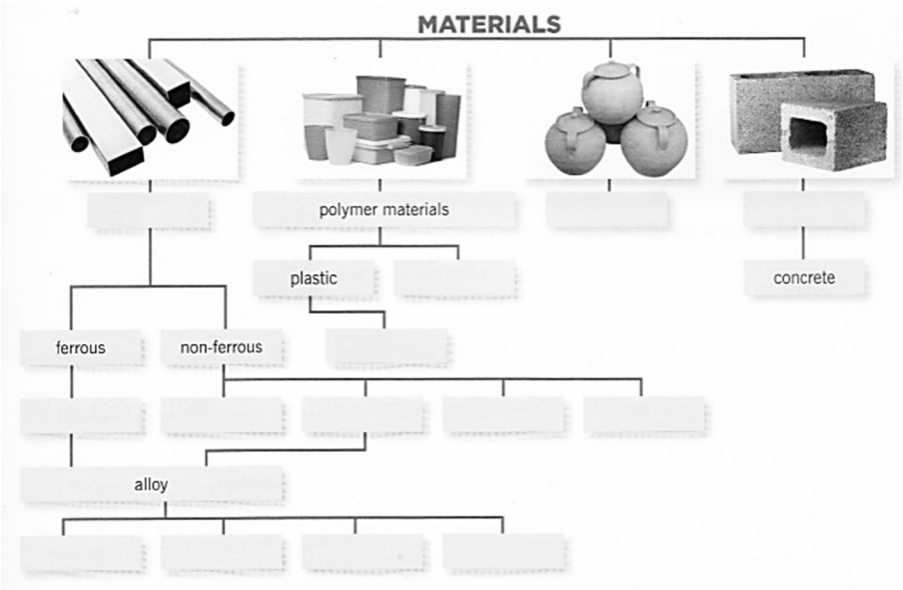
1. Alloy	a) a building material made from a mixture of broken stone or gravel, sand, cement, and water, which can be spread or poured into moulds and forms a mass resembling stone on hardening.
2. Steel	b) a yellow alloy of copper and zinc.
3. PVC	c) a metal made by combining two or more metallic elements, especially to give greater strength or resistance to corrosion.
4. Concrete	d) a tough chemically resistant synthetic resin made by polymerizing vinyl chloride and used for a wide variety of products including pipes, flooring, and sheeting.
5. Brass	e) any of the various hard, brittle, heat-resistant and corrosion-resistant materials made by shaping and then firing a nonmetallic mineral, such as clay, at a high temperature.

6. Ferrous materials	f) 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.
7. Ceramic	g) metals that have a significant amount of iron in its composition
8. Iron	h) a hard, strong grey or bluish-grey alloy of iron with carbon and usually other elements, used as a structural and fabricating material.

5. Answer the following questions:

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

6. Complete the following diagram using the information from the text in exercise 3.



7. Scan the table which follows to find a material which is:

1. Soft.
2. Ductile
3. Malleable
4. Tough
5. Scratch-resistant
6. Conductive and malleable
7. Durable and hard
8. Stiff and brittle
9. Ductile and corrosion-resistant
10. Heat-resistant and chemical-resistant

Materials	Properties	Uses
Metals		
Aluminium	Light, soft, ductile, highly conductive, corrosion-resistant	Aircraft, engine components, foil, cooking utensils
Copper	Very malleable, tough and ductile, highly conductive, corrosion-resistant	Electric wiring, PCBs, tubing
Brass (65% copper, 35 % zinc)	Very corrosion-resistant. Casts well, easily machined. Can be work hardened. Good conductor.	Valves, taps, castings, ship fittings, electrical contacts.
Mild steel (iron with 0.15% to 0.3% carbon)	High strength, ductile, tough, fairly malleable. Cannot be hardened and tempered. Low cost. Poor corrosion resistance.	General purpose
High carbon steel (iron with 0.7 % to 1.4 % carbon)	The hardest of carbon steels but less ductile and malleable. Can be hardened and tempered.	Cutting tools such as drills, files, saws
Thermoplastics		
ABS	High impact strength and toughness, scratch-resistant, light and durable	Safety helmets, car components, telephones, kitchenware

Окончание таблицы

Materials	Properties	Uses
Acrylic	Stiff, hard, very durable, clear, can be polished easily. Can be formed easily	Aircraft canopies, baths, double glazing
Nylon	Hard, tough, wear-resistant, self-lubricating	Bearings, gears, casings for power tools
Thermosetting plastics		
Epoxy resin	High strength when reinforced, good chemical and wear resistance	Adhesives, encapsulation of electronic components
Polyester resin	Stiff, hard, brittle. Good chemical and heat resistance	Moulding, boat and car bodies
Urea formaldehyde	Stiff, hard, strong, brittle, heat-resistant, and a good electrical insulator	Electrical fittings, adhesives

8. Scan the table to find:

1. A metal used to make aircraft
2. Plastics used for adhesives
3. Steel which can be hardened
4. An alloy suitable for castings
5. A plastic with very low friction
6. A material suitable for safety helmets
7. A metal suitable for salt-water environment
8. A metal for general construction use but which should be protected from corrosion
9. A plastic for car bodies
10. The metal used for the conductors in printed circuit boards

9. Use the table in exercise 7 to make definitions of each of the materials in column A. Choose the correct information in columns B and C to describe the materials in column A.

A	B	C
1. An alloy		allows heat or current to flow easily
2. A thermoplastic		remains rigid at high temperatures
3. Mild steel		does not allow heat or current to flow easily
4. A conductor	a metal	contains iron and 0.7% to 1.4% carbon
5. An insulator	a material	becomes plastic when heated
6. High carbon steel	an alloy	contains iron and 0.15% to 0.3% carbon
7. Brass		formed by mixing other metals or elements
8. A thermosetting plastic		consists of copper and zinc

9. Using the information from exercises 3, 7 and 9 make a monologue on the topic "Engineering Materials".

Unit 3. NANOTECHNOLOGY

Vocabulary

1. dimension, *n* – измерение, величина, объем
2. diverse, *adj.* – иной, отличный, разнообразный, разный
3. extension, *n* – распространение, предоставление
4. conventional, *adj.* – обусловленный, стандартный, условный
5. approach, *v* – приближаться, подходить
6. assembly, *n* – общество, сбор
7. assume, *v* – присваивать
8. assemble, *v* – подбирать, собирать, монтировать
9. entities, *n* – сущность
10. evolve, *v* – развивать, раскрывать

1. Answer the following questions:

1. What do you know about nanotechnology and its application in contemporary life?
2. What does nanotechnology deal with?
3. Which properties do materials hundreds of nanometers in size exhibit?

2. Read the text:

OVERVIEW OF NANOTECHNOLOGY

Nanoscience is the study of phenomena and manipulation of materials at atomic, molecular and macromolecular scales, where properties differ significantly from those at a larger scale.

Nanoscience is not just the science of the small, but the science in which materials with small dimension show new physical phenomena, collectively called quantum effects, which are size-dependent and dramatically different from the properties of *macroscale materials*.

Bulk materials (the 'big' pieces of materials) possess continuous (macroscopic) physical properties. The same applies to micron-sized materials (e.g. a grain of sand). But when particles assume *nanoscale dimensions*, the principles of classic physics are no longer capable of describing their behaviour (movement, energy, etc.): at these dimensions, the principles of *quantum mechanics principles.* Nanotechnology is defined thus:

‘Nanotechnology is the design, characterisation, production and application of structures, devices and systems by controlling shape and size at the *nanometre scale.’*

The nanometre scale is conventionally defined as 1 to 100 nm. One nanometre is one billionth of a metre (10^{-9} m). Nanoscience and nanotechnology deal with clusters of atoms of 1 nm in at least one dimension.

For scale comparisons, the average human hair is about 80,000 nanometers wide, and a single *virus particle* is about 100 nanometers in width. The prefix “nano” comes from the Greek word “nenos”, meaning “dwarf”. Scientists originally used the prefix just to indicate “very small”, as in “nanoplankton”, but it now means one-billionth, just as “milli” means one-thousandth, and “micro” means one-millionth.

The story of nanotechnology begins in the 1950s and 1960s, when most engineers were thinking big, not small. This was the era of big cars, big atomic bombs, big jets, and big plans for sending people into outer space. Other researchers, however, focused on making things small. The invention of the transistor in 1947 and the first integrated circuit (IC) in 1959 launched an era of *electronics miniaturization*.

As *electronics engineers* focused on making things smaller, engineers and scientists from other fields also turned their focus to small things – atoms and molecules. Usually the credit for inspiring nanotechnology goes to a lecture by Richard Phillips Feynman, a brilliant physicist. Feynman himself didn't use the word "nanotechnology"; in fact, only in the 1980s did this new field of study get a name – Nanotechnology. This new name was popularized by physicist K. Eric Drexler.

Two main approaches are used in nanotechnology. In the "*bottom-up" approach,* materials and devices are built from molecular components which assemble themselves chemically by principles of molecular recognition. In the "top-down" approach, nano-objects are constructed from larger entities without atomic-level control.

Areas of physics such as nanoelectronics, nanomechanics and nanophotonics have evolved during the last few decades to provide a basic scientific foundation of nanotechnology.

3. The following words are all from the text above. Find them in the text:

manipulation behavior particle chemically dimension

4. For each word read the sentence it occurs in and answer the questions:

g) Is the word positive, negative or neutral?

h) Is it a noun, adjective, adverb or verb?

i) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

5. Match the words to their translations:

1. circuit	a)применение
2.dimension	b) сконцентрироваться
3. recognition.	c)значительно
4. approach	d)подход
5. focus	e) распознавание
6. significantly	f) схема, цепь
7. application	g)измерение

6. Give the English equivalents to the following words and expressions:

1. материал
2. интегральная схема
3. большой объем
4. открывать/запускать
5. пучок,
6. сущность,
7. разнообразный,
8. величина,
9. подход,
10. обратить внимание

7. Make up 10 sentences with the words in exercise 6.

8. Answer the questions:

1. What is nanotechnology?
2. What does nanotechnology deal with?
3. Is a nanometer one-billionth of a matter?
4. How many approaches are used in nanotechnology? What are they?

5. What do prefixes “milli” and “micro” mean?
6. What areas of physics have evolved during the last few decades?

9. Complete the sentences:

1. Nanoscience is the study of ….....
2. Bulk materials possess.....
3. In the "bottom-up" approach, materials and devices are built from ….....
4. In the "top-down" approach, nanoobjects are constructed from ….....
5. Nanoelectronics, nanomechanics and nanophotonics provide ….....

10. Match the words to their definitions:

1. macroscale	a) an extremely small piece of matter
2. assume	b) a large scale used for measuring things such as weather movements
3. particle	c) a quality in a substance or material, especially one that means that it can be used in a particular way:
4. property	d) to accept something to be true without question or proof:
5. matter	e) a substance that has inertia and occupies physical space.

GRAMMAR FOCUS

NOUN PHRASES

The meaning of a noun can be made more precise by the words immediately before or after it. These words and the noun together are called the **noun phrase.** Pre-modifying words help to describe the noun.

E.g., *resource extraction, production line.*

In academic writing, noun + noun phrases are common because they contain a lot of information in a shorter phrase:

satellite systems (Compare: systems that are based on a network of satellites)

communication devices (Compare: devices that are used for communication)

You can use noun+ noun phrase to help you paraphrase the text. Compare:

Many young people use texting as their main method of communicating with each other.

The main *communication method* among many young people is texting.

11. Translate into Russian, paying attention to noun phrases:

A human mind, a factory inspector, a carbon nanotube, a space flight report, tumor tissue, a dictionary reference, citation index, design goals, a functional parameter list, labor productivity increase, shape memory alloys, cable TV, quantum dots, chemistry laboratory, cancer nanotechnology, laptop computer, gene engineering, multi-cylinder engine, large-scale work, laboratory assistant, drug therapy, computer centre, the environment protection, a square mile, education system, energy source, cancer treatment therapy, four-wheel control system, large-scale work, the traffic speed increase, the house ventilation facilities, arch bridge construction site, thermoelectric generator development, flight control equipment, spare parts list, a requirement document, nanoscale devices.

12. Translate into English:

1. загрязнение воздуха
2. потребление энергии
3. производительность труда
4. космический полет
5. реконструкция железнодорожного моста
6. человеческий фактор
7. проблема улучшения наземного транспорта
8. компьютер третьего поколения
9. образовательная система
10. углеродные нанотрубки

13. Translate the phrases from the text given in italics.

14. Listen to track 1 (“Nanoengineering”) and fill in the gaps:

1. Nanotechnology is an umbrella term that encompasses all fields of science that operate on the ... .

2. It would take approximately 40,000 nanometers lined up in a row to equal the width of a **… …. .**

3. The general term, nanotechnology, is sometimes used to refer to … … that have improved properties due to being fortified with nanoscale materials.

4. Nanoengineering is an ... ... that builds biochemical structures smaller than bacterium, which function like microscopic factories.

5. This is possible by utilizing basic ... ... at the atomic or molecular level.

Turn to Appendix 1 and check yourself.

15. Scan the following text and note down the essential information. Sum up the main points of the text. Create the glossary if necessary.

APPLICATIONS AND BENEFITS OF NANOENGINEERING

The socio-economic benefit of nanoengineering will be ubiquitous and lead to improved safety, security, and standard of living throughout the world. Future materials and structures will have vastly improved properties and durability. Smart machines will control their own performance, preserve their integrity, and partially self-repair when damaged, and when they are worn out or obsolete, they will be programmed to demanufacture and be recycled into new machines.

Building without machining may be another outgrowth of nanoengineering. Nanoengineering will produce new launch vehicles, lightweight agile aircraft, and may allow the human exploration of space. Major areas of impact include future space missions that will use hybrid nanocomposites to provide a wholesale reduction in weight in space vehicle systems through material substitution, redesign, and integration; autonomous reconfigurable structures will increase speeds, reduce fuel consumption, reduce pollution, reduce noise, and provide lasting performance for aircraft; intelligent materials will provide structural health and performance monitoring to prevent degradation and failure of structures in all types of critical applications; nanocoatings, fillers, sprays, and films will provide protection from abrasion, EMI, heat, and provide artificial skins for materials.

Commercial applications of nanocomposite materials potentially include all composite material products, brake disks, turbine engine shrouds, composite bushings, brake parts, metallic composites, smart materials, biosensing, and power harvesting. New applications will emerge as our knowledge increases.

Nanoengineering is also important in fuel cells where functionalized nanotubes may store hydrogen safely for use in automobiles. Electronics, medicine, and computing are other areas where nanotechnology promises advances. Indeed, our vision of nanoengineering is to obtain nanoscale control over the synthesis of matter to build designer materials that can be used to solve the most difficult scientific and medical problems that face humanity.

16. Using the information you have learnt, make a monologue on the topic “Nanotechnology”.

Unit 4. AUTOMATION AND ROBOTICS.

TEXT 1

Vocabulary
involve, *v* – вовлекать
increased productivity - увеличение производительности
safety, *n* – безопасность
reduce, *v* – уменьшить
variability, *n* – непостоянство, неустойчивость, вариабельность
consistency, *n* – постоянство, стабильность
hazard, *n* – опасность
retrain, *v* – переобучать, переквалифицировать
expenditure, *n* – затраты
relocate, *v* – переместить
maintenance, *n* – обслуживание
subjugate, *v* – подчинять, покорять
yield, *v* – предоставить, приносить
substantial opportunities - значительные возможности

1. Answer the questions:
1. Is technology a friend or an enemy for a human?
2. Can you imagine and describe our world without technology?
3. Name the spheres of our life that technology impacts?

2. Read the text:

What else we will do on this earth if we're not improving our self every day. But it's important that technological development should be environmental and human-friendly. Technology is a flower for life, not a productivity killer. We're looking like a robotic human and it's the biggest example of how technology has changed our lives positively and negatively. Technology is in the air, water, food, education, business, office, electricity, marketing, data storage, communication, cars, parking, traveling, foods, shopping, and banks, etc. It's almost everywhere and in everything that is involved in our daily life.

Advantages commonly attributed to automation include higher production rates and increased productivity, more efficient use of materials, better

product quality, improved safety, shorter workweeks for labour, and reduced factory lead times. Higher output and increased productivity have been two of the biggest reasons in justifying the use of automation. Despite the claims of high quality from good workmanship by humans, automated systems typically perform the manufacturing process with less variability than human workers, resulting in greater control and consistency of product quality. Also, increased process control makes more efficient use of materials, resulting in less scrap.

Worker safety is an important reason for automating an industrial operation. Automated systems often remove workers from the workplace, thus safeguarding them against the hazards of the factory environment.

Another benefit of automation is the reduction in the number of hours worked on average per week by factory workers. About 1900 the average workweek was approximately 70 hours. This has gradually been reduced to a standard workweek of about 40 hours. Mechanization and automation have played a significant role in this reduction. Finally, the time required to process a typical production order through the factory is generally reduced with automation.

A main disadvantage often associated with automation is worker displacement. Despite the social benefits that might result from retraining displaced workers for other jobs, in almost all cases the worker whose job has been taken over by a machine undergoes a period of emotional stress. In addition to displacement from work, the worker may be displaced geographically. In order to find other work, an individual may have to relocate, which is another source of stress.

Other disadvantages of automated equipment include the high capital expenditure required to invest in automation (an automated system can cost millions of dollars to design, fabricate, and install), a higher level of maintenance needed than with a manually operated machine, and a generally lower degree of flexibility in terms of the possible products as compared with a manual system (even flexible automation is less flexible than humans, the most versatile machines of all).

Also there are potential risks that automation technology will ultimately subjugate rather than serve humankind. The risks include the possibility that workers will become slaves to automated machines, that the privacy of humans will be invaded by vast computer data networks, that human error in the

management of technology will somehow endanger civilization, and that society will become dependent on automation for its economic well-being.

These dangers aside, automation technology, if used wisely and effectively, can yield substantial opportunities for the future. There is an opportunity to relieve humans from repetitive, hazardous, and unpleasant labour in all forms. And there is an opportunity for future automation technologies to provide a growing social and economic environment in which humans can enjoy a higher standard of living and a better way of life.

3. The following words are all from the text above. Find them in the text:

equipment subjugate substantial ultimately versatile

4. For each word read the sentence it occurs in and answer the questions:

a) Is the word positive, negative or neutral?

b) Is it a noun, adjective, adverb or verb?

c) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

5. Match the synonyms:

1. specialized	a) improved
2. originally	b)danger
3. claims	c) initially
4. increased	d) threaten
5. workmanship	e) requirements
6. hazard	f) dedicated
7. endanger	g) subordinate
8. substantial	h)protect
9. dependent	j) professional skill
10. safeguard	i) considerable

6. Answer the questions:

1. What's important for technological development?
2. In what way has technology changed our lives?
3. What are the biggest reasons justifying the use of automation?
4. Why do automated systems provide worker safety?
5. How long was the average workweek about 1900?

6. What has changed since that time?
7. What has played a significant role in this reduction?
8. What are the main disadvantages of automation?
9. Why can benefits of automation be stressful for workers?
10. Are there any risks that technology will ultimately enslave humankind?
11. In what way can society become dependent on automation?
12. What opportunities does it give for the future?

7. Complete the sentences:

1. Technology is a flower for life…
2. Technology is in the air, water…
3. …automation include higher production rates and increased productivity.
4. Despite the claims of high quality from good workmanship by humans…
5. Also, increased process control makes…
6. Automated systems …, thus safeguarding them against the hazards of the factory environment.
7. Finally, the time required to process a typical production order…
8. In addition to displacement from work,…
9. Also there are potential risks that automation technology…
10. The risks include the possibility that workers will become slaves to automated machines, … that human error in the management of technology will somehow endanger civilization.
11. …if used wisely and effectively, can yield substantial opportunities for the future.
12. And there is an opportunity for future automation technologies…

8. Complete the sentences using the words from the box:

Simple assembly-line automation adopted power independent work piece motorized labor mechanization (x2)

1. Manufacture system designed to extend the capacity of machines is called … .
2. Automated manufacture arose out of division of … and … of the factory.
3. The division of labor (that is, the reduction of a manufacturing or service process into its smallest … steps) developed in the latter half of the 18th century.

4. Another step necessary in the development of automation was … .

5. As a result of the development of power transfer specialized machines were … and their production efficiency was improved.

6. The development of … technology also gave rise to the factory system of production.

7. The transfer machine is a device used to move a … from one specialized machine tool to another.

8. Industrial robots were originally designed only to perform … tasks.

9. The goal of the … … system was to make automobiles available to people who previously could not afford them.

10. This method of production was … by most automobile manufacturers and rapidly became known as Detroit automation.

9. Make up sentences using the expressions:

equipment – division of labor – manufacturing prosses – increased production - simplification of work – production efficiency – to be integrated with – method of production.

10. Give the English equivalents to the following words and word combinations:

1. более высокие темпы производства
2. повышение безопасности
3. оправдывать
4. привести к большему контролю
5. стабильность качества продукции
6. заводские условия
7. играть значительную роль
8. смещение рабочих
9. подвергаться стрессу
10. машина с ручным управлением
11. служить человечеству
12. огромные компьютерные данные
13. экономическое благосостояние
14. более высокий уровень жизни

11. Translate into English:

1. Технологии изменили способы обучения и методы обучения.

2. В прошлом мы не могли так быстро и гибко получать данные, информацию и знания.

3. Но сегодня благодаря технологиям существуют онлайн-школы и различные курсы.

4. Сегодня у нас есть мобильные телефоны, интернет, социальные сети и видеоконференции для общения с любым человеком по всему миру.

5. Преимущество современной связи заключается в том, что это быстрый и простой способ общения.

6. Технологии увеличили темп нашей жизни, но качество снижается.

7. В прежние времена у людей было меньше оборудования для работ по дому и в поле, однако, лучшая физическая выносливость.

8. Сейчас мы не способны критически мыслить, поэтому и изобретаем искусственный интеллект для будущего поколения.

9. Кроме того перегрузка информацией и чрезмерное использование оборудования делает нас зависимыми от них.

10. Мы ищем друзей в интернете, но ничего не знаем о соседях и их проблемах.

12. Speak about possible changes in our lives due to technology in 20 years. If necessary, look up the Internet. Use the following questions as a plan:

1. Will future technologies facilitate our life or make it more difficult?

2. Will the efficiency that technology allows make the business world more competitive?

3. How will future businessmen differ from previous entrepreneurs?

4. How will the process of decision making change? What will it be based on?

5. What devices and gadgets will have the prefix “smart”?

6. What will we be able to do due to the development of 3D printing?

7. Apple has already introduced fingerprint password technology. What other personalized forms of security will begin to appear?

8. Will technology become to be more prevalent in making our everyday monotonous tasks? Can you name examples?

9. Will it be possible to see droids roaming the streets with us in our daily life, doing jobs we used to do?

10. Is it possible that every surface in our houses, businesses, and hospitals will be some sort of computer?

11. Will health technologies become readily available?

12. Will our health be more manageable due to our digital complete image?
13. Can you think of any dire consequences next to the great benefits that innovations pose?

TEXT 2

Vocabulary

1. overlap, *v* – перекрывать, дублировать друг друга
2. exploration, *n* – исследование
3. entire field – вся область
4. appearance, *n* – внешность
5. application, *n* – применение, приложение
6. vastly, *adv.* – весьма, в значительной степени
7. repetitive task – повторяющееся задание, действие
8. incredibly, *adv.* – невероятно
9. disrupt, *v* – нарушать, мешать
10. capability, *n* – способность
11. remote, *adj.* – удаленный
12. observation, *n* – наблюдение
13. unobtrusively, *adv.* – ненавязчиво, незаметно
14. commonplace, *n* – обычное явление, обычное дело
15. menial, *n* – домашняя прислуга
16. surgeon, *n* – хирург
17. boundaries, *n* – границы
18. conservationist, *n* – защитник природных ресурсов
19. at the forefront – на переднем плане
20. off-shore drilling – бурение на шельфе

1. Answer the questions:

1. Can you name the ways robots change our life?
2. In which areas are robots the best helpers?
3. Where are robots more important: in our homes or in industry?

2. Read the text and choose the most suitable heading from list A-I for each part of the article. There are two extra headings you don't need to use:

A. Consumer robots
B. Medical robots
C. Industrial robots

D. Military robots
E. Aerospace robots
F. Aquatic Robots
G. Rescue Robots
H. Exploration robots
I. Robot locomotion

TYPES OF ROBOTS

Robots are primarily differentiated based on two categories: use and movement. Of course, there is a great deal of overlap in many of these categories; drones, for example, can be classified as either aerospace, consumer, or exploration. This text contains broad definitions for each different type and gives relevant examples.

1._____

Each of these different categories of robots contains machines of all shapes and sizes. One thing that's true across the entire field of robotics is that a robot's appearance will often be informed by the way it moves through the environment.

Despite this, many robots that look and move the same might have vastly different applications in the real world, which requires us to consider our mechanical companions from a variety of angles.

2._____

These robots often comprise the most basic form of machine — a stationary or semi-stationary device that executes a repetitive task. The robots are generally some of the least intelligent due to the fact that the work they do is incredibly simple and the environments in which they work are fairly free of external influences that could disrupt their routines.

3._____

These cybernetic adventurers can range in complexity from simple probes to fully autonomous spacecraft. They are used to explore the farthest reaches of space and the darkest trenches of the ocean floor, boldly going where no man has gone before.

Some of the more famous examples of these, such as the Mars Rover Opportunity, are a type of robot known as 'Remotely Operated Vehicle'

(or ROV) that performs some autonomous functions while having the capability of being operated by a remote operator or pilot. These robots typically come equipped with advanced observation or manipulation features.

4._____

These types of robots are so commonplace that many people fail to see them as robots at all! These are the little household helpers that unobtrusively improve the lives of countless homeowners the world over. The classic example of such a robot is the roomba, an autonomous cleaning machine complete with sensors to help it navigate any space you put it in.

More recently, simplistic AI has started to fuse with the robots and the internet of things to give us devices such as the Amazon Alexa or Google Home.

5._____

Aside from production, exploration, and menial tasks, robots can also be literal lifesavers.

These robots can range from autonomous arms that help surgeons perform delicate operations to the emerging field of mind-controlled robotic prosthetics and exoskeletons. While we probably won't see fully autonomous surgeons for many years to come, doctor-operated robots have pushed the boundaries of medicine in terms of what can be accomplished without having to resort to risky invasive procedures.

6._____

These robots are, in some capacity, able to fly. They differ from exploration robots in that they don't include aquatic automatons or surface rovers. Common forms of these robots are autonomous or remote controlled drones or spacecraft that can be used for a variety of purposes such as research, military intelligence, or deep space exploration.

7._____

These robots go far beyond deep-sea exploration. They can work with the coast guard as unmanned boats and have often been used by marine biologists and conservationists to help supplement parts of marine ecosystems that have been ravaged by climate change and industrialization efforts like off-shore drilling.

Interestingly, the robotics is also one of the subfields at the forefront of biorobotics, where the robots developed take inspiration from organic animals in the wild for how they move.

3. The following words are all from the text above. Find them in the text:

surface autonomous exploration menial accomplished

4. For each word read the sentence it occurs in and answer the questions:

j) Is the word positive, negative or neutral?

k) Is it a noun, adjective, adverb or verb?

l) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

5. Answer the questions:

1. Which two categories can robots be differentiated in?
2. What does a robot's appearance depend on?
3. May robots have different applications despite they look and move the same?
4. Which robots are the least intelligent? Which work do they usually perform?
5. What are aerospace robots used for?
6. What are the functions of the Mars Rover Opportunity? What is it equipped with?
7. Which robots improve the lives of many homeowners?
8. Which robots help surgeons perform delicate operations?
9. What purposes are remote controlled drones used for?
10. Why do marine biologists and conservationists deploy robots?

6. Complete the sentences:

1. Drones, for example, can be classified as…
2. …contains machines of all shapes and sizes.
3. The robots are generally some of the least intelligent due to the fact…
4. Some of the more famous examples of these, ……, are a type of robot known as 'Remotely Operated Vehicle'.
5. These types of robots are so commonplace…
6. The classic example of such a robot is the roomba, …… to help it navigate any space you put it in.
7. These robots can range from autonomous arms…

8. …. they don't include aquatic automatons or surface rovers.
9. These robots go far beyond ...
10. Interestingly, ….., where the robots developed take inspiration from organic animals.

7. Words in families. Form an adjective and a noun. Write the words as in the example:

Example: to relate – relative- relativity
Continue: to contain – … – …
to classify – … – …
to appear – … – …
to move – … – …
to require – … – …
to consider – … – …
to vary – … – …
to execute – … – …
to disrupt – … – …
to equip – … – …

8. Give the English equivalents of the following words and word combinations:

Соответствующие примеры, всех форм и размеров, с разных точек зрения, стационарное устройство, выполнять повторяющееся действие, невероятно простой, нарушить рутину, исследовать самые дальние уголки космоса, впадины океанского дна, расширить границы медицины, множество целей, военная разведка, дополнить части морских экосистем, опустошенный изменением климата.

9. Make up 7 sentences from the words and expressions from exercise 8.

10. Put the words in the correct order to make sentences. Learn more about flying robots:

1. Robo/ most/ robots/ the/ Flying/ types/ are/ popular.
2. incorporate/ are/ machines/ their/ into/ companies/ the/ planning/ business/ multinational/ Some/ big/ to.
3. are/ sound/ aerodynamically/ and/ They/ strong.

4. Amazon/ flying/ through/ shipping/ drones/ areas,/ products/ In/ has/ some/ started.

5. autonomous/ These/ 15/ up/ miles/ can/ and/ electric/ drones/ fly/ to.

6. at/ packages/ 5 pounds/ than/ deliver/ minutes/ less/ They/ weighing/ most/ in/ 30.

7. Flying/ useful/ in/ robots/ are/ search/ and/ rescue/ also/ missions.

8. be/ for/ large/ They/ can/ land/ victims/ used/ to/ survey/ areas/ of/ looking.

9. areas/ sent/ be/ robots/ Flying/ can/ too/ into/ human/where/ for/ is/ dangerous/ a/ it.

10. to/ sensors/ Due/ their/ rescue/ send/ information/ to/ they/ important/ teams.

11. Translate into English:

1. Целью роботов является совместная работа с людьми и улучшение её качества.

2. Роботы помогают нам, если занятие слишком утомительно, отнимает много времени или просто невозможно.

3. Сейчас роботы дорогие, но технологии совершенствуются, цены будут снижаться, и роботы-помощники станут обычным явлением.

4. Вся система доставки может быть заменена дронами и роботами.

5. От Google до Toyota автомобильные фирмы работают над самоуправляемыми автомобилями.

6. Во время утренней поездки на работу вы сможете вздремнуть или почитать книгу, пока машина управляет вместо вас.

7. С использованием роботов и 3D-принтеров могут быть построены целые здания.

8. Здравоохранение – еще одна область, где роботы очень популярны.

9. Роботы не могут полностью заменить медицинский персонал, но делают его работу более эффективным.

10. Роботы и искусственный интеллект также помогают при диагностике пациентов.

11. Недавно появился робот, способный распознавать эмоции.

12. Он может подбодрить вас или оставить в покое, если вы раздражены.

12. Watch the video about flying robots https://youtu.be/53ZuKzr2QoA and answer the questions:

1. Which system do the robots use to avoid obstacles?
2. What kind of system do they use to accomplish complex tasks?
3. Do their collective systems provide simple or complex behaviours?
4. What is the next step of air robotics field?
5. What will we be able to do due to the robots?

13. Watch the video again, check your answers and fill in the gaps:

The next step of air robotics field is to 1._____ with environments and 2._____ or perching is one example for that. Once we have robots that can freely fly around and 3._____ objects from flights, we will be able to 4._____ objects, approach to objects, 5._____ environments. The market value of drones of the next 10 years is estimated to be 6._____ dollars worldwide which is huge. So there are a lot of tasks that we can do with flying robots such as 7._____ pollution in forests, observing 8._____, protect animals from poaching, for example, or use them for search –and- rescue applications after 9._____. There is a huge field of applications. I'm very excited about the future of this field. But I think it is important to keep in mind that applications are benefiting humanity. We take the 10._____, as well to build robots that are beneficial to 11._____and used in ethical and positive way.

14. Speak on the topic "Can Robots Replace Humans?" Use the following questions as a plan:

1. Science fiction writers invented robots many years ago. But for some reason they didn't appear in our streets. Why? Who or what prevents it?
2. Will robots live according to their own laws and as it is convenient for them?
3. Will they perform actions quicker and more accurately if they have feelings and emotions?
4. Who will work in the social and health sectors in 50 years? Will robots fully replace humans?
5. Will the need for IT specialists and employees with technical knowledge increase since robots are becoming more and more integrated into our lives?

6. What are the advantages of robots over humans in space exploration?
7. Why are people better cosmonauts?
8. Will a human remain indispensable in professions that require a non – “template-based” approach? Can you name any of these professions?
9. Does a robot need such abstract concepts as “power” and “freedom”?
10. Will robots be able to rebel and enslave or even destroy their creators?
11. Will robots take care of us and protect us from troubles and problems?

Module II. TRAINING FUTURE ENGINEERS

Unit 1. MY FACULTY

1. Answer the question:

What do you know about the faculty you study at?

2. Read the text:

I study at Novosibirsk State Technical University, which is made up of 73 departments, organized into 10 faculties. They are:

- Automation and Computer Science
- Business
- Humanities
- Physical Engineering
- Applied Mathematics and Computer Science
- Electromechanical Engineering
- Radio Engineering and Electronics
- Aircraft Engineering
- Aircraft Engineering
- Mechanics and Technology

NSTU IS an international academic community with more than 20,000 students and members of staff. It operates on a huge campus in Novosibirsk. Besides 10 faculties, The University accommodates several independent research-oriented laboratories.

I am a student of … Faculty. The faculty trains specialists in … .The study training is conducted using a multilevel structure of education.

Bachelor's degree delivers a broad understanding of fundamental Engineering Science and a thorough introduction to Economics, Management and Communication. Students are admitted through competitive examinations.

Specialist degree opens access to professional practice in areas like medicine, engineering and teaching, and it is also the traditional prerequisite for admission to doctoral studies. The qualification of Specialist Diploma is awarded after studies lasting 5 to 6 years. The diploma is awarded in all fields of study, including various specializations. The State final attestation for a Specialist Diploma covers the defense of a project or a thesis and State final examinations. The procedure for the State final attestation and for the award of the Diploma as well as the content of Diploma supplement is the same as for the Bachelor's degree. The Specialist Diploma gives access to a PhD program or employment.

Master's degree is generally of two years duration and has a more pronounced research focus in comparison to the Specialist Diploma. Each faculty has its own specific admission requirements and **curriculum**. The **curriculum** is a combination of theoretical and practical courses which consist of lectures, independent exercises, computer simulations, laboratory works, and group assignments. At the end of the study course students defend a Master's **thesis.**

The first two years of study at my faculty cover core concepts, via lectures and practical experience (course work and lab work).

However, there are subjects that are specialized from day one and are taught with special applications and examples. Further material is covered in specialist units. I major in … .

You will also learn skills that cross all the streams, such as computing, systems engineering and design. There is extensive mathematical content throughout.

In year three and four there is greater flexibility for you to pursue options that interest you. Some units relate to particular application areas, such as … or … . Other units study particular technologies, such as … . The diversity of topics makes this a challenging degree but the reward is a uniquely broad education.

When you submit your application, you usually include your grades for the academic qualifications you have achieved at the standard secondary school level. There are certain application deadlines. So, if you would like to study at … Faculty, make sure you meet all the necessary requirements and apply on time.

3. The following words are all from the text above. Find them in the text:

thesis pursue prerequisite uniquely procedure

4. For each word read the sentence it occurs in and answer the questions:

m) Is the word positive, negative or neutral?

n) Is it a noun, adjective, adverb or verb?

o) Can you think of a word with a similar meaning (synonym) and one with an opposite meaning (antonym)?

5. Create the glossary for the text. Complete the table.

WORD	PRONUNCIATION	TRANSLATION
Automation and Computer Science		
Humanities		
Physical Engineering		
Applied Mathematics and Computer Science		
Electromechanical Engineering		
Radio Engineering and Electronics		
Aircraft Engineering		
Mechanics and Technology		
academic community		
to accommodate		

Окончание таблицы

WORD	PRONUNCIATION	TRANSLATION
research-oriented		
multilevel structure		
to conduct		
to be admitted through competitive examinations		
admission requirements		
to cover core concepts		
throughout		
to pursue		
reward		

6. Translate the text using the glossary.

7. Answer the questions:

1. What faculty do you study at?
2. Is the admission to the faculty competitive?
3. What is a multilevel education? What levels does it include?
4. What do the first two years of study cover?
5. What subjects do you major in?
6. What is the main characteristic feature of years three and four?
7. What do you include when you submit your application?
8. How many faculties does NSTU comprise? Can you enumerate them?

8. Give the English equivalents of the following words and word combinations:

1. международное академическое сообщество
2. огромный студенческий городок

3. широкое понимание основ инженерного дела
4. степень бакалавра
5. особенные требования к поступлению
6. основные предметы
7. большая гибкость
8. ярко выраженная исследовательская направленность

9. Make up 8 sentences of your own using the words and word combinations above.

GRAMMAR FOCUS

LATIN AND GREEK BORROWINGS IN ENGLISH

Study the following examples from the text:

- Each faculty has its own specific admission requirements and **curriculum**.
- At the end of the study course students defend a Master's **thesis**
- Latin and Greek borrowings have their own plural endings. Study the following table:

	ending	Latin/Greek plural
a	**- us**	**- i**
b	**- a**	**- ae**
c	**- um**	**- a**
d	**- ex**	**- ices**
e	**- ix**	**- ices**
f	**- is**	**- es**
g	**- on**	**- a**

10. Consult the table and give the plural of the following foreign words:

a) radius, stimulus, genius, cactus, fungus
b) alga, formula, vertebra, antenna
c) curriculum, datum, medium, millennium, stratum, bacterium
d) index
e) appendix
f) axis, basis, crisis, thesis, analysis
g) phenomenon, criterion

11. Translate into English:

1. На поверхности этой планеты происходят странные явления.
2. Многие университеты имеют разные программы.
3. Каковы критерии оценки этого эксперимента?
4. Земля вращается вокруг своей оси.
5. Многие бактерии вызывают болезни.
6. Эти данные надежны.
7. Она запоминает формулы очень легко.

12. Retell the text. Use task 7 as a plan.

13. Listen to track 2 "Aircraft Faculty" and fill in the gaps:

1. Faculty of aircraft prepares … … professionals with broad scientific and technical outlook in the … and … of aircraft and systems.

2. … physical and mathematical training, serious … … students receive at the university and its basic enterprises - institutes of the Siberian Branch of Russian Academy of Sciences, industrial … … and design bureaus, advanced aircraft and machine-building plants in Novosibirsk.

3. … of the faculty work successfully designers, … , department heads and aviation enterprises and machine building services; occupy senior positions in the administration and the mayor's office of Novosibirsk.

Turn to Appendix 1 and check yourself.

Unit 2. MY FIELD OF STUDY

1. Answer the questions:

1. What is your field of study? Why did you choose this field to study?
2. Is the engineering/science/technology field different than what you thought it would be?

2. Read the text:

My field of study is Computer Science (Material Engineering, Aircraft Engineering) with a major in Cyber Security (Materials Science and Engineering, Technosphere Safety). I selected this major as soon as I entered the University in…. I enjoyed math and science in high school, and as a result when I was in 11 grade I became involved with a project called the National Engineering Design Challenge. I helped design the computer system on my

team project, I had the opportunity to present it at a regional competition and I really enjoyed the technical and teamwork aspects of this work. So, I thought that a career in engineering would be a good fit for me.

Besides, I enjoy problem solving and love a challenge, and I believe that Computer Science (Material Engineering, Aircraft Engineering) will be a challenging, but rewarding course of study.

The more I learned about engineering and the broad range of career opportunities available to engineers, the more excited I became about my chosen field.

CYBER SECURITY ENGINEERS

In general, security engineers develop and supervise data and technology security systems to help prevent breaches, taps, and leaks associated with cybercrime. Alternate titles for this career include information assurance engineer, information systems security engineer, and information security engineer.

Companies may combine a security engineering role with an analyst's role, but these positions typically focus on different things. Security analysts identify cybersecurity weaknesses, while security engineers build systems, such as firewalls and intrusion detection systems, to defend against attacks or leaks.

As commerce and data storage increasingly move into the cloud, organizations increasingly require robust information security systems. As a result, information security professionals can work across diverse industries, such as computer systems design, manufacturing, insurance, finance, and education.

MATERIALS ENGINEERS

Materials engineers develop, process, and test materials used to create a wide range of products.

They generally work in offices where they have access to computers and design equipment. Others work in factories or research and development laboratories. Materials engineers typically work full time and may work overtime hours when necessary.

Materials engineers must have a Bachelor’s degree in materials science and engineering or in a related engineering field. Completing internships and

cooperative engineering programs while in school can be helpful in getting hired as a materials engineer.

Employment of materials engineers is projected to show little or no change over the next ten years. Materials engineers will be needed to design uses for new materials both in traditional industries, such as aerospace manufacturing, and in industries focused on new medical or scientific products. However, most materials engineers work in manufacturing industries, many of which are expected to have declines or little change in employment.

AIRCRAFT ENGINEERS

An aircraft engineer is also called an aircraft maintenance engineer.

Aircraft engineering involves maintenance and servicing of all parts of an aircraft.

An aircraft maintenance engineer can be working in a line base or workshop maintenance environment. Line maintenance is the maintenance which is performed at ramp usually during the turn around. It can be a transit check, trouble shooting or component replacement. Nowadays A checks and B checks are also being performed on the ramp. Base maintenance is usually a scheduled maintenance which is performed at dedicated places such hangar or maintenance bays, overhaul workshops where the component is usually overhauled. At the completion of the maintenance task a certifying staff signs a release stating that maintenance has been performed in accordance with the applicable airworthiness requirements.

To become an aircraft maintenance engineer it is necessary to obtain special education.

The subjects you are required to study during the course are:

- Mathematics. – Basics of Arithmetic, Algebra and Geometry.
- Physics. – Good understanding of mechanics, thermodynamics, optics, wave motion and sound.
- Electrical Fundamentals. – A deep understanding of electricity generation, current resistance, voltage and power. Level 3 understanding of motors, generators lights, AC and DC current, and electrical distribution in the aircraft.
- Electronic Fundamentals.
- Digital Technics.
- Material and Hardware. – Study of materials used on aircraft and its properties. Materials such as ferrous metals, aluminum, steel, alloys, titanium, etc. A level three study on aircraft hardware such as screws, nuts, bolts, rivets and fasteners.
- Maintenance Practices. – A study on safe practices during aircraft and its component maintenance.
- Basic Aerodynamics. – A study on atmosphere and aerodynamics.
- Human Factors. – A study on human performance and its limitation on aircraft maintenance environment. And a deep study to avoid human errors during maintenance of the aircraft.
- Aviation Legislation. – Study of responsibilities and privileges of an aircraft mechanic and engineer.
- Airframe Systems. – A study of all aircraft mechanical systems, such as hydraulic systems, air condition system, fire protection system, fuel system, ice and rain protection, landing gear system etc.
- Avionics Systems. – A study of electrical and electronics systems, such as lighting, communication, navigation, and aircraft instrument systems.
- Piston Engines. – A deep study on aircraft piston engines and its associated systems.
- Turbine Engines. – A deep study on aircraft turbine engines and its associated systems.
- Propeller. – A deep study on aircraft propeller and its associated systems.

Aircraft engineers and mechanics deeply study all aircraft system description, its operation and maintenance.

The scope of an established aircraft engineer is currently really good. But fresh graduates who are non-skilled or semi-skilled mechanics are still struggling to find a job or struggling to survive with the income they get from the job.

I am sure engineering/technology field provides the meaningful, challenging, cutting-edge work that I expect. Because I have the opportunity for internships and I am trained by very professional lecturers, I have a fairly good idea of what the engineering field in Computer Science (Material Engineering, Aircraft Engineering) is like. The opportunity to gain this knowledge is one of the key reasons that I would encourage students in technical fields to pursue studies at NSTU, Automation and Computer Engineering Faculty (Mechanical Engineering Faculty, Aircraft Faculty). Although I have a strong background in the basics of IT engineering (Material Engineering, Aircraft Engineering) and in critical-thinking skills, one of the major transitions I will have to make is moving from textbook engineering to real-world engineering. At the University, the homework problems, projects, labs that are part of the courses are contrived and all have clear answers that the students are supposed to obtain. However, in practical engineering, a problem can have multiple correct solutions based upon the customer technical requirements. One of the key components of the job is finding the best technical solution. This is a real challenge because it is a skill that is not taught in an engineering curriculum and because a lot of the instincts that are used to make these types of decisions are developed over years of experience. This is a vital part of the engineering/technology field and is as important as having a strong technical background.

3. Create the glossary for the text. Complete the table.

WORD	PRONUNCIATION	TRANSLATION
broad range		
career opportunities		
rewarding		
available		
cutting-edge work		
encourage		
to pursue		

Окончание таблицы

WORD	PRONUNCIATION	TRANSLATION
critical-thinking skills		
contrived		
technical requirements		
curriculum		
technical background		
develop and supervise data		
prevent breaches, taps, and leaks		
identify cybersecurity weaknesses		
intrusion detection system		
data storage		

4. Translate the text using the glossary

5. Find information about your field of study. Create the glossary for your speech. Prepare a 3-minute speech or a presentation. Use the following plan:

1. Describe your educational opportunities at your faculty.
2. Speak about your area of specialization.
3. Speak about your choice of the major.
4. Tell about other subjects you study.
5. Share your impressions of your specialization.
6. Speak about your job opportunities and career prospects.

6. Listen to track 3 “My Field of Study” and tick the correct statements:

1. The author planned his career very carefully.
2. The author preferred reading books to gadgets.
3. The attitude of society to those who choose humanities is rather negative.
4. The author took up Bio and Math at school.
5. The author got a degree in Biotechnology.
6. The author does not take pleasure in coding.

Turn to Appendix 1 and check yourself.

Module III. ENGLISH FOR SPECIFIC PURPOSES

Unit I. LATEST DEVELPOMENTS AND FUTURE TRENDS IN MY BRANCH OF ENGINEERING

Vocabulary

Eco-friendly, *adj.* – экологически безвредный

Conventional, *adj.* – традиционный, стандартный, обыкновенный

Internal combustion engine – двигатель внутреннего сгорания

Fuel cell – тепловыделяющий элемент, топливный бак-отсек

Solar cell – фотоэлектрическая панель, солнечная батарея на фото-элементах

Ultracapacitor, *n* – ультраконденсатор

Power beaming – направленная передача энергии

Efficient, *adj.* – эффективный, экономичный

Failure, *n* – неисправность, поломка

Residential area – жилой район, населенный пункт

Rupture, *v* – разрываться, давать трещину

Short-circuit, *v* - выйти из строя в результате короткого замыкания

Range, *n* – дальность полета

Hindrance, *n* – помеха, препятствие

Dwindle, *v* – сокращать, уменьшать

Supply/demand – спрос-предложение

Operating costs – эксплуатационные расходы, производственные из-держжки

Rotorcraft, *n* – винтокрылый летательный аппарат

Crude oil – неочищенная сырая нефть, нефть-сырец

1. Work in pairs. Discuss these questions:

1. How will aircrafts change in the next 10 years?
2. What comes to your mind when you hear the word “eco-friendly”?
3. Have you ever heard anything about eco-friendly electric planes? What do you know about them?
4. In what ways are electric planes better than conventional ones?

Share your ideas with the rest of the group.

2. Watch the video about the first all-electric commercial plane https://www.youtube.com/watch?v=hHApAWHO_bc Compare your ideas given in exercise 1 to the ones from the video.

3. Work in small groups. Brainstorm the advantages and disadvantages of all-electric planes and list them in the table below:

Pros and Cons of All-Electric Airplanes

Advantages	Disadvantages

4. Read and translate the text about electric aviation.

THE GOOD AND THE BAD ABOUT ELECTRIC AVIATION

Airplanes tend to emit greenhouse gases into the atmosphere. This is leading to addition to global warming causes. Moreover, it requires a large amount of fuel to fly. No wonder, aware of the carbon emissions it entails, there are many of us who try to make air travel environment-friendly. Nevertheless, it is never enough, there’s a lot that we cannot change. In fact, even scientists are speculating whether eco-friendly air traveling is possible or not.

However, even when we decide to imagine something like that, there's one particular concept that appears again and again. It is that of *electric aviation*.

What if electricity is used in place of fuel to power the plane? Though they won't replace passenger airliners anytime soon, small, zero-emission, electric planes are flying today. An electric aircraft runs on electric motors rather than internal combustion engines, with electricity coming from fuel cells, solar cells, ultracapacitors, power beaming and batteries. Currently flying electric aircraft are mostly experimental demonstrators, including manned and vehicles.

The Good

1. Efficiency:

Electric aircraft, when compared with regular planes with combustion engines, are much more efficient. Because of the electric motors used in electric aircraft, they can be 95 % efficient compared to 18 %–23 % efficiency of regular plane engines. And therefore the electric aircraft lose a smaller amount of energy in form of heat. Electric motors are three to four times better at driving an airplane propeller. They are much less noisy and more reliable when compared to combustion fuel engines.

2. Reliability:

Electric aircraft are much more reliable, as they have increased safety due to a decreased chance of mechanical failure and a less risk of explosion or fire in the event of a collision. Since they emit a less amount of heat so they don't require much amount of cooling air flowing over them (which can slow down the engine due to drag) as combustion engines do, which is a very big deal with airplanes. This has a minimal effect on the speed of the electric airplane turning out to be a great advantage.

3. Quieter:

Due to a better efficiency of electric airplanes, they are much quieter, and can therefore be located nearby residential areas. Because electric planes are quieter, airports can be built closer to destinations, and they are capable of extremely short takeoffs since they don't have to gradually accelerate to lift-off speeds.

The Bad

1. Heavy battery:

The electric power motors used in electric aircrafts are heavier for airplanes to stay up in the air. They may be toxic, rupture easily, short-circuit, catch fire and are expensive. These were the main significant disadvantages for an electric airplane.

Can this be avoided?

The disadvantages in an electric plane can be avoided by using some new techniques. To reduce the weight of airplanes, super-lightweight carbon fiber construction techniques can be used. To reduce the required power, a better sailplane design can be implemented. A hybrid solution including a small jet-fuel-powered auxiliary power unit can be brought into use for the longer endurance mission requirements of the largest aviation market segments. This solution provides enhanced efficiency and reduced cost, while avoiding the expense and weight of an all-electric battery-powered aircraft. The highenergy-density of jet fuel will supplement the benefits of electric propulsion. Moreover, lighter batteries like lithium-ion batteries can be used.

2. Range:

Though there will be environmental and cost benefits associated with the elimination of consumption of fossil fuels and resultant emissions by making use of electric planes, their range will be a hindrance in its implementation. The current range in electric planes is low (about 100-250 miles), which is quite impractical in case of flying to distant destinations.

The bottom line

Not to speak of the environmental damage, even the world fuel reserves are continuing to dwindle as demand increases. This inversion of the supply/demand cycle will increase the operating costs of all fuel-based vehicles, especially in the aviation industry. Nowhere is this more apparent than in the commercial helicopter market, where the critical role rotorcraft play could be threatened by spiraling fuel costs. The supply of normal crude oil is estimated to last another 40 years with current yearly demand. At some point, increasing demand together with higher oil prices will make alternative resources very attractive.

5. Turn back to the table in exercise 3. Compare your ideas with the ones from the text. Are they the same? What new information have you learned about the advantages and disadvantages of all-electric airplanes?

6. Work in groups. Choose one of the airplanes below:

1. Yuneec E430
2. Cessna Grand Caravan
3. Solar Impulse
4. Pipistrel Alpha Electro
5. Eviation Alice

Use the Internet to search for the information about its properties, design and operation. Make a short presentation of the aircraft. Share the information with the rest of the group.

7. Make a presentation on the topic "Latest Developments in My Branch of Engineering". Use the information from this electronic course https://dispace.edu.nstu.ru/didesk/course/show/7413 to make a good presentation. Use the following plan:

1. Who made the development? When was it made?
2. What enabled this development? (e.g., physical laws, physical and chemical properties of materials, etc.)
3. The essence of the development.
4. The value of the development (how it may be used further on, its scientific and manufacturing prospects).

Unit II. HOW TO MAKE A SUMMARY OF A TEXT

1. Watch the video about summarizing texts in English https:// www. youtube.com/watch?v=QJdYjNCKCj4

What new information have you learnt from the video?

2. Study the following information about how to write a summary:

A summary must have:

- the source
- the paraphrased main idea of the original
- the major supporting points
- the major explanations (reasons, causes, effects)
- the description of methods and results
- reporting verbs
- must be written in Present Simple or Past Simple
- specific, concrete language

A summary does not:

- have specific examples or details (a lot of dates, numbers, statistics)
- express your opinion
- use original sentences
- exceed 1/3 length of the original
- suffer from wordiness

Stages

1) Skim the article for general comprehension, identify the main topic and idea Find the main point of the article.

2) Re-read the article. Underline important ideas, circle key terms. Divide the article into sections and label each section in the margins, make up a plan. Cover briefly each point of the plan.

Note the main idea of each paragraph if the article is short.

3) Write brief summaries of each section. This should become a brief outline of the article. While doing so, divide the information into:

– Key points: cite them literally

– Significant points: compress and rephrase them

– Minor points: omit them

4) Write the main point of the article in your own words (a sentence that expresses the central idea of the article as you have determined it from steps above).

5) Write a draft of the summary. Combine all the information.

6) Review the draft and finalize your summary.

3. Study the following table:

Useful Phrases to Summarize the Text

1.	Introduction	1.1	*The title of the text is … .* *The passage is called/entitled … .*
		1.2	*The author of text/passage/extract is… .* *The text/passage/extract was written by… .*
		1.3	*The text/passage/extract under consideration/analysis is taken from the book/newspaper/web-site called… .* *The author of the passage is not mentioned, neither is the source.*
		1.4	*The subject of the text/passage/extract is… .* *The text/passage/extract tells us about/ describes/is devoted to… .* *The text/passage/extract/paper is about… .* *This text/passage/extract/paper deals with (the problem of)… .*
2.	Text structure analysis	2.1	*The text/passage/extract can be (sub)divided/split into … logical parts.* *The text/passage/extract falls into … logical parts.*
		2.2	*The first/second/third part is about/describes/is devoted to/analyses/points out… .* *In the first/second/third part the author writes about/analyses the problem of/gives his point of view on… .* *Attention is concentrated on … in the first/second/third part.* *So, the author writes that… .*
3.	Conclusion		*In conclusion, the author says… .* *Summing up, the author points out …* *To sum up, the author emphasizes that …*

4. Turn to exercise 4 in unit 1 and make a written summary of the text "The Good and the Bad about Electric Aviation".

5. Work in pairs. Exchange your summaries, correct them and discuss the mistakes.

6. Choose an article from your specialist area which consists of 5000 printed characters. Make a written summary of the text using the information you have learnt from exercises 1, 2 and 3.

Appendix 1

SCRIPTS

Track 1. Nanoengineering

Nanoengineering is one field of nanotechnology. Nanotechnology is an umbrella term that encompasses all fields of science that operate on the ***nanoscale.*** A nanometer is one billionth of a meter, or three to five atoms in width. It would take approximately 40,000 nanometers lined up in a row to equal the width of **a human hair**. Nanoengineering concerns itself with manipulating processes that occur on the scale of 1-100 nanometers.

The general term, nanotechnology, is sometimes used to refer to **common products** that have improved properties due to being fortified with nanoscale materials. One example is nano-improved tooth-colored enamel, as used by dentists for fillings. The general use of the term "nanotechnology" then differs from the more specific sciences that fall under its heading.

Nanoengineering is an **interdisciplinary science** that builds biochemical structures smaller than bacterium, which function like microscopic factories. This is possible by utilizing basic **biochemical processes** at the atomic or molecular level. In simple terms, *molecules* interact through natural processes, and nanoengineering takes advantage of those processes by direct manipulation.

Track 2. Aircraft Faculty

Faculty of aircraft prepares highly qualified professionals with broad scientific and technical outlook in the design and manufacture of aircraft and systems. Fundamental physical and mathematical training, serious practical experience students receive at the university and its basic enterprises – institutes of the Siberian Branch of Russian Academy of Sciences, industrial

research institutes and design bureaus, advanced aircraft and machine-building plants in Novosibirsk. On the basis of the faculty operates Student Design Bureau . Graduates of the faculty work successfully designers, technologists, department heads and aviation enterprises and machine building services; occupy senior positions in the administration and the mayor's office of Novosibirsk.

Track 3. My Field of Study

The question "What is your field of study? " is easily answered. It is Computer Science. However, the question "Why did you take it?" is harder to respond to.

I'm not the kind to plan out my career. When asked the typical question if "What to do want to be when you grow up?" I never had a real answer. I had two major things I liked though – books and gadgets. And yet, though I liked *reading* books, I didn't like *discussing* them, in an academic sort of way. For me, reading was more about stories. That, combined with the society's attitude towards those who took up humanities, means I never went the literary way for a career.

So I took up the science stream in school, specifically Bio with Maths, for various reasons. Now, there are two very clear cut options for a science student – IIT-JEE and AIPMT. My parents went ahead and enrolled me into IIT coaching, since I didn't find Biology to my liking. I should clarify that it wasn't that I was forced into taking JEE coaching, but I wasn't interested in anything specifically, so I let my parents decide.

So, a few stumbles and I got an AIR of 3647. I went through counselling, pretty much filling choices semi-randomly, and got Dual Degree program in Biotechnology in IIT Madras. I decided to give it another shot, and dropped a year, and next year my AIR was 88.

Good enough, I could take pretty much any branch I wanted. So I just went ahead and took the one with the most hype – Computer Science. Of course, it wasn't totally random. I had the aforementioned passion for gadgets – specifically computers, and I had taken an online course on Python earlier, just for the hell of it, and liked what I saw of programming.

Luckily, it turned out to be a good fit for me. I enjoy coding, and from what I've seen of other branches in my two years at college, I would not have enjoyed any other branch. So, that's how I came to be in CS.

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