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Технические факультеты и специальности

Методические указания
для студентов
всех технических специальностей

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Работа выполнена на кафедре иностранных языков ТФ НГТУ

Настоящие методические указания предназначены для студентов технических специальностей, по которым ведется подготовка в НГТУ.

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. Основной принцип работы состоит в активизации студентов с помощью коммуникативных упражнений. Все тексты и задания связаны с профессиональной подготовкой будущих специалистов и соответствует государственному образовательному стандарту.

Методические указания включают в себя восемь модулей, каждый из которых включает пять разделов, систему лексических и грамматических упражнений с учетом вокабуляра и грамматических структур, характерных для подъязыка специальности.

Указания могут быть использованы для аудиторной и внеаудиторной работы, в зависимости от целей, поставленных преподавателем.

Compiled by Ivanova. O. V. (Units 3, 4),
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MODULE I

Aircraft Faculty

Unit 1

Before you read

1.1. Answer the questions:

1. What is the name of the faculty you study at?
2. Why have you chosen this faculty?
3. What do you know about your future profession?
4. Do you know what specialities your faculty provides?
5. What do you know about your faculty? Share the information with your group mates.

1.2. Read the text

AIRCRAFT FACULTY

Aviation industry and space engineering are the most advanced and rapidly developing branches of national economy. Modern aircraft have great flight speeds, maneuverability, reliability, comfort and ecological safety. Only advanced countries can produce aircraft of high competitive capacity. Russia is one of these countries. All advantages of aircraft become possible if their creators-scientists, engineers, technicians and workers are well educated and skilled.

The Aircraft Faculty of Novosibirsk State Technical University was set up in 1956 to meet the needs for highly qualified specialists in the sphere of designing and manufacturing aircraft and systems. It trains engineers, researchers and scholars who will be able to apply the latest achievements of aerospace and military technologies in all branches of national economy.

Students are given fundamental theoretical training and practical skills in a wide range of major engineering subjects. Special attention is devoted to bringing up new generations of researchers. The main goal of the academic staff is not only to give students the knowledge and skills necessary for their professional careers of engineers but to develop their talents of generating new ideas.

The academic staff of the Faculty make a great contribution to the development of aerospace engineering bringing fame and high reputation to the faculty. The Aircraft Faculty of NSTU is famous in the world for its achievements in science and technology as well as a high quality of training. Young people from many countries prefer to get education at this Faculty.

The Faculty has a great number of well-equipped laboratories with a complete range of instruments and machines for specialized courses, computer classes equipped with up-to-date personal computers having an access to the Internet.

During the period of studies students undergo their practical training in specialized laboratories at the Institutes of the Siberian Division of Russian Academy of Sciences and leading aviation institutions and plants of Novosibirsk. Students may enrich their knowledge and better prepare for professional and research work in the Student's Design Office set up at the Faculty.

The Faculty awards Bachelor's, Engineer's and Master's degrees. Graduates may prefer to undertake a Postgraduate programme of study leading to a higher degree.

The students of the Faculty may major in any of the following areas:

1) Airplane and helicopter construction
2) Life-support systems
3) Aero hydrodynamics
4) Dynamics and strength of machines
5) Mechanical equipment of aircraft
6) Destruction weapon and ammunition
7) Environmental protection systems
8) Manufacturing processes and production safety
9) Low temperature physics and engineering
10) Economics and management in aircraft construction

The graduates of the Aircraft Faculty work as engineers, designers and technologists at aviation plants, design departments and research institutions and occupy professional, technical and managerial positions in the local administration, city council and federal government of the Russian Federation.

Vocabulary

1. aircraft – летательный аппарат, самолет
2. aerospace – аэрокосмический
3. ammunition – боеприпасы

4. branch – отрасль
5. competitive – конкурентоспособный
6. city council – мэрия, муниципалитет
7. designing – проектирование
8. design office – конструкторское бюро
9. destruction weapon – средства поражения
10. dynamics – динамика
11. environmental protection systems – система защиты окружающей среды
12. economics and management – экономика и управление
13. enrich- обогатить
14. flight – полет
15. helicopter – вертолет
16. hydrodynamics – гидродинамика
17. life-support systems – системы жизнеобеспечения
18. maneuverability – маневренность
19. manufacturing process – технологический процесс
20. national economy – народное хозяйство
21. reliability – надежность
22. safety – безопасность
23. space engineering – космическая техника
24. strength of machines – прочность летательных аппаратов
25. scholar – ученый
26. to meet the needs for – удовлетворить потребность в
27. up-to-date – современный
28. weapon – оружие

Comprehension

1.3. Answer the questions

1. What main features do modern aircraft possess?
2. Does Russia produce modern aircraft?
3. What is necessary for Russia to be among the countries capable of producing aircraft of high competitive capacity?
4. When was the Aircraft Faculty of NSTU set up?
5. What specialists does the Aircraft Faculty train?
6. What knowledge and skills does the Faculty give its students?
7. Is the Faculty well-equipped? What is it equipped with?
8. Where do the students of the Faculty receive practical training?

9. What specialities does the Faculty provide?
10. What opportunities are there for the graduates of the Faculty?

Vocabulary development

1.4. Match English words to their Russian equivalents

1. speed	a) конкурентоспособный
2. maneuverability	b) конструкторское бюро
3. competitive	c) отделение
4. design office	d) обогатить
5. division	e) скорость
6. enrich	f) маневренность
7. helicopter	g) защита
8. life-support	h) оружие
9. weapon	i) вертолет
10. protection	j) жизнеобеспечение

1.5. Make pairs of synonyms:

1. scholar	a) modern
2. goal	b) quickly
3. rapidly	c) manufacture
4. produce	d) aim
5. up-to-date	e) scientist
6. undertake	f) security
7. safety	g) to start doing
8. maneuver	h) ability
9. capacity	i) move

Grammar revision

1.6. Open the brackets using the verbs in the form of the Gerund or Participle

1. Russia needs good specialists in the sphere (to design and manufacture) aircraft.
2. The scholars (to work) at the faculty are famous in the world.
3. Computer classes are equipped with personal computers (to have) an access to the Internet.
4. Our specialists possess the talent (to generate) new ideas.
5. The Faculty offers a program of study (to lead) to Candidate of Science degree.

6. Russia is one of the countries capable (to produce) competitive aircraft.

7. Students participate in research work (to bring) fame to their Faculty.

8. The Faculty pays special attention to (to bring up) new generations of researchers.

Speaking

1.7. Make a presentation on "The Aircraft Faculty"

Unit 2

Before you read

2.1. Read the following international words:

academician [ə,kædɪ'mɪʃn]	***monoplane ['monəv***,pleɪn]
aviation [,eɪvɪ'eɪʃn]	modernization [***mod***ənaɪ'zeɪʃn]
biplane ['baɪ,pleɪn]	maneuverable [mə 'nu:vərəbl]
bomber ['bomə]	legend [' ledʒənd]
parachute ['pærə ,ʃu:t]	

2.2. Match the words in A with their synonyms in B.

A	B
1. invent	в) project
2. construct	b) soar
3. design	c) build
4. glide	d) drawing
5. type	e) devise
6. sketch	*t*) kind

2.3. Use the words from 2.2 in the sentences below, change the form if necessary.

1) Scientists …a test that shows who is mostly like to get the disease.

2) Leonardo da Vinci's … show an immensely intensive and inquiring mind.

3) We are doing …on pollution.

4) …a square with the sides of 5 centimeters.

5) I don't like that … of thing.

6) She watched the dove …above the trees.

2.4. Match the words in A with their Russian equivalents in B.

1. a number of	a) с помощью
2. about	b) через, сквозь
3. until	c) тоже, также
4. by means of	d) с тех пор
5. too close	e) около, приблизительно
6. through	f) ряд, несколько
7. also	g) пока (не)
8. so	h) слишком близко
9. since then	i) таким образом
10. before	k) до, перед

2.5. Translate the following into Russian:

Man-flight, man-powered aircraft, man-made aircraft, fixed-wing glider, powered airplane

2.6. Make the list of pioneers of aviation, then read the text and complete your list.

PIONEERS OF AVIATION

The history of Man's achievement in flight goes back through centuries. The first recorded attempt of flying in heavier-than-air craft is found in the Greek legend of Daedalus and his son Icarus who succeeded in propelling themselves through the air by means of wings attached to the body with wax. But the experiment proved fatal to Icarus who flew too close to the Sun, which melted the wax, the wings dropped off and he was drowned in the sea.

In the 15th century the great Italian painter, scientist and engineer Leonardo da Vinci began his investigations into the possibility of man-flight. He designed the first men-powered aircraft and devised a fixed-wing glider and a helicopter. He also invented the first prototype to the modern parachute. Leonardo constructed a number of models with which he experimented. But his mathematical calculations, observations and sketches demonstrating his ideas on the possibility of soaring in the air came to light only in the late 19th century.

Since then many experimenters tried to build and fly man-made aircraft. But successes were random until in the 19th century a German scientist O.Lilienthal designed and constructed several types of gliders. Between 1890 and 1895 he built and flew five monoplane fixed-wing gliders and two biplane types. Actually Lilienthal made about 2.500 successful flights be-

tween 1893 and 1896 becoming the greatest of the early pioneers of gliding and so the father of heavier-than-air flight.

In December, 1903 the two brothers by the name of Wright made the first successful controlled and powered flight. But the very first powered airplane was designed and constructed by ***A.***S.Mojaisky in 1884, 19 years before the Wright brothers' flight.

Vocabulary development

2.8. Find in the text English equivalents for the following:

полет человека; летательный аппарат, приводимый в движение мускульной силой человека; планер с неподвижным крылом; вертолет; парить в воздухе; планировать; полет на летательном аппарате тяжелее воздуха; облетать планер; управляемый полет; моторный полет (полет с двигателем); созданный человеком летательный аппарат.

2.9. Make up possible word combinations.

A	**B**
1) controlled	a) aircraft
2) fixed-wing	b) speed
3) heavier-than-air	c) planes
4) man-made	d) glider
5) aero-hydrodynamic	e) flight
6) screw	f) craft
7) flight	g) institute
8) all-metal	h) giants
9) multiengined	i) bombers
10) long-distance	j) fighters
11) highly-maneuverable	k) theory
12) high-speed	

2.10. Match the words in A to the definitions in B

A	**B**
1. investigation	a) suitable and likely to make smth. happen or succeed
2. grateful	b) happening or chosen without any definite plan, aim, or pattern
3. observation	c) experience, endure
4. favourable	d) the process of watching smth. or smb. carefully
5. undergo	e) a careful search or examination in order to discover facts, etc
6. random	f) thankful for gifts, favours, etc

Comprehension

2.11. Answer the following questions on the text.

1 Where is the first recorded attempt of flying in heavier-than-air craft found?
2. According to the legend, were the first experiments with the wings, successful?
3. Who began first serious investigations into the possibility of man-flight?
4. What did Leonardo-da-Vinci design and invent?
5. When did his ideas on the possibility of soaring in the air come to light?
6. Who constructed several types of gliders?
7. How many successful flights did O.Lilienthal make between 1893 and 1896?
8. Who made the first controlled and powered flight?

2.12. Mark each statement as T (True), F (False) or N (Not Mentioned).

1. Man's first attempts in flying heavier-than-air aircraft were successful from the very beginning.
2. The first serious investigations into the possibility of man-flight took place in the 17^{th} century.
3. Leonardo-da-Vinci devised only one thing: a fixed-wing glider.
4. Leonardo constructed 6 models with which he experimented.
5. Since then no more experiments were carried out to build and fly men-made aircraft.
6. Lilienthal was the greatest of the early pioneers of gliding.

Grammar revision

2.13. Translate the sentences paying attention to the use of the Gerund.

1. Flying from Los-Angeles to Tokyo on board a new supersonic craft will take two hours.
2. The only way of overcoming the great air resistance at high velocities is flying higher.
3. In flowing over the aircraft's surface the fuel cools its skin.
4. On taking off from the Earth the rocket must get as much acceleration as possible to work up the necessary speed.

2.14. Fill in the blanks with prepositions where necessary.

1. At low speeds the engine can use turbines ___compressing the air before mixing it with fuel in the combustion chamber.
2. Daedalus succeeded ___ propelling himself through the air by means of wings attached to the body with wax.

3. The aircraft of this type will be capable___flying_at five times above the speed of the sound.
4. The first recorded attempt ___ flying in heavier-than-air craft is found in the Greek legend.
5. ___using supercomputers it is possible to avoid ____ making mistakes in extremely complicated computations
6. The Civil Aviation Council marked the beginning of the systematic work creating Soviet Civil Aviation.

2.15. Translate into English:

1. В 15 веке итальянский художник и ученый Леонардо да Винчи начал изучать возможность полета человека.

2. Он спроектировал первый летательный аппарат, приводимый в движение мускульной силой человека, а также изобрел планер с неподвижным крылом и вертолет.

3. Можайский был первым, кто спроектировал и построил самолет с силовым двигателем.

4. Для строительства самолетов в царской России не было специализированной промышленной базы.

5. В 1918 правительство организовало Институт Аэро-Гидродинамики во главе с Н.Жуковским.

6. Н.Жуковского можно считать основоположником современной аэродинамики благодаря его известной теории крыла самолета и гребного винта.(The wing and the screw theory)

Speaking

2.16. Make a report on "The Development of aviation"

Unit 3

Before you read

3.1. Discuss in pairs:

What should be taken into account while designing modern aircraft structures?

3.2. Read the text and check your answers.

MODERN TRENDS IN DESIGN OF AIRCRAFT STRUCTURES

Modern aircrafts must undergo severe conditions such as differences in atmospheric pressure and temperature, or heavy structural load applied upon vehicle components. The current generations of civil transport aircraft were designed for at least 20 to 25 years and up to 90,000 flights. Consequently, they are usually products of complex synthesis of various technologies and sciences, including developing new design methods, preparing advanced materials.

Future aircraft types are designed for the same goals, but structure with higher fatigue life (endurance), higher damage tolerance capability and higher corrosion resistance are required to minimize the maintenance costs and to comply with the requirements of the operator and the enhanced airworthiness regulations.

During the design of aircraft structures several aspects have to be considered to reach sufficient static strength as well as sufficient fatigue and damage tolerance behavior. The result of iterative calculations is an optimized design regarding weight, costs and aircraft performance. An evaluation of the strength, detailed design, and fabrication must show that a catastrophic failure due to fatigue, corrosion, or accidental damage, will be avoided throughout the operational life of the airplane. The ultimate purpose of the damage tolerance evaluation is the development of a recommended structural inspection program considering probable damage locations, crack initiation mechanisms, crack growth time histories and crack detectability. The damage tolerance design principle comprises two categories which are "single load path" and "multiple load path" structure. Single load path is where the applied loads are eventually distributed through a single member within an assembly, the failure of which would result in the loss of the structural integrity of the component involved. Multiple load path is identified with redundant structures in which (with the failure of individual elements) the applied loads would be safely distributed to other load carrying members.

Innovative materials research and engineering are essential to get the high-strength, heat-resistant, lightweight structures required in advanced subsonic and supersonic aircraft. General and specific research opportunities were determined for the civil aircraft industry using the HSCT (high-speed civil transport) as a basis for analysis.

The designer of the craft must also consider the man-hours required to supply and maintain the vehicle, as well as the training required for main-

tenance crews. Maintenance costs and training are also considerations in the design of civil aircraft. The length of runways and their load-bearing weight may influence the proposed gross weight of the plane, the design of its wings, and the configuration of its landing gear.

Vocabulary

1. structures(зд.) – устройства, аппараты
2. fatigue – тяжёлая работа, усталость
3. comply with the requirements- соблюдать требования
4. airworthiness – годность к полётам
5. load paths – путь нагружения (мех.)
6. static strength – прочность при статической нагрузке
7. damage tolerance behavior – режим работы при допустимых повреждениях
8. delectability – обнаруружительная способность
9. structural integrity – конструктивная целостность
10. redundant structure – статистически неопределимая конструкция
11. load carrying member- механизм, подвергаемый нагрузке
12. landing gear – шасси

Vocabulary development

3.3. Choose the correct translation for the following phrases.

1) **vehicle components**

a)составные механизмы b) детали летательных аппаратов
c)компоненты механизмов d) детальная разработка

2) **comply with the requirements**

a)соответствовать требованиям b) противоречить требованиям
c)согласовывать требования d) соглашаться с требованиями

3) **crack initiation**

a)провал инициативы b) источник проблемы
c) возникновение трещины d) устранение дефекта

4) **crack detectability**

a) дефект детали b) способность обнаружить поломку
c) поломка в устройстве обнаружения d) способность находить устройства

5) man-hours

a) часы работы
b) трудовые ресурсы
c)человеческий фактор
d) трудозатраты;

6) **landing gear**

a) шасси
b) шины
c) колесо
d) кабина.

Comprehension

3.4. Say whether the given statements are true or false. Correct the false statements.

1. The period of operation of modern civil transport aircraft is about 50 years.
2. Costs are not taken into account while designing aircraft structures.
3. Fatigue, corrosion, accidental damage can cause a catastrophic failure.
4. Structural inspection program can consider only probable damage locations.
5. Multiple load path is identified with redundant structures in which the applied loads would be safely distributed to other load carrying members.
6. Traditional materials research and engineering is essential to achieve the high-strength, heat-resistant, lightweight structures required in advanced subsonic and supersonic aircraft.
7. HSCT means high-speed civil trends.
8. The length of runways may influence the proposed gross weight of the plane.

Grammar revision

3.5. Put down the conditional sentences (1st, 2nd, 3d type), using the given notes. Then translate the sentences you've made.

For example: be late for the conference -go by plane

If we are late for the conference, we will go by plane. (Если нам не хватит времени, мы полетим на самолёте.)

1. consider a lot of aspects – design modern aircraft structures
2. want to avoid the failure – evaluate the strength, detailed design and fabrication
3. use a single load path – the applied loads are eventually distributed through a single member within an assembly

4. carry out innovative materials research – get the high-strength, heat-resistant and lightweight structures
5. want to maintain the vehicle properly – have a qualified technical staff

Speaking

3.6. Write a list of key words and phrases (15-20) to help you retell the text "Modern Trends in Design of Aircraft Structures".

Unit 4

4.1. Read the text and choose the sentence, conveying the main idea of the text.

1. Composite materials are very expensive and that is why they are seldom applied in modern aircraft construction.
2. Composite material consists of two or more separate components and the most widely used composite material in tactical aircraft is a carbon fibre/epoxy mix.
3. A lot of commercial firms and enterprises carry out researches into new types of alloys for aircraft construction.

COMPOSITE MATERIALS IN THE CONSTRUCTION OF MODERN AIRCRAFT

One of the important applications of technological progress to modern aircraft is the use of composite materials in their construction. Moulded into an epoxy resin matrix, they have produced extremely tough and stable materials that are replacing aluminum and aluminum alloys.

Advances in technology have had an enormous impact on the shape, performance, reliability and composition of modern aircraft and fly-by-wire flight control systems (FCS). Propulsion systems also have improved and advances in structural technology have influenced the way aircraft are designed, produced and maintained.

Until the late 1960s, almost all tactical aircraft were composed primarily of aluminum and its alloys. High-speed aircraft used a sizeable amount of titanium, but high cost and the demanding production requirements of this material limited it to moderately high temperature applications. Consequently the latest tactical aircraft incorporate many non-metallic composite materials. Sixteen per cent of the structural weight of the Boeing F/A-18E/F and

Lockheed F/A-22 are made up of about 20 per cent of composite material. Future military aircraft such as the F-35 joint strike fighter are expected to have a composite content of at least 35 per cent.

Composite material is made up of two or more separate components that when combined result in property changes that differ from the original materials. Composites most widely used in combat aircraft are composed of high-strength fibres of glass, boron, plastic or carbon that are embedded in an epoxy resin matrix. The fibres have very high strength, a uniform structure and lack flaws. The epoxy resin bonds with the fibres in the curing process to produce an extremely tough and stable material.

The most widely used composite material in tactical aircraft is a carbon fibre/epoxy mix. Carbon epoxy has eclipsed boron-based composites because it is much cheaper to produce, easier to machine and drill, and can be formed into complex shapes to produce structural members such as spars and ribs. Other fibres typified by Dupont's Kevlar also are being used in aircraft production. Kevlar is less dense than carbon fibres but has inferior mechanical properties. It is used in pressure vessels, for ballistic protection and as lightweight fibreglass non-structural parts.

Big advantage of composites is that they are relatively insensitive to flaws. Fatigue testing of composite structures demonstrated their high resistance to cracking and that fractures generally do not propagate. Composite materials are very stable and so are not subject to corrosion as are metallic structures. However, in the design process, careful attention must be paid to composite/metal interaction because through galvanic action some metals will corrode when in contact with carbon fibre/resin laminate.

However, composites do require new skills. Design, production and quality-control personnel have had to adjust to the way they operate in order to take full advantage of the potential of these materials and to produce it economically. The computer has been a major ally in the move to composites. Computer-aided design (CAD) has made it much easier to develop composite structures and to understand their relationship with other elements of an aircraft more thoroughly.

Composites have already had a major impact on military aircraft design and manufacture concepts and also have been used extensively in the latest generation of commercial aircraft. As this technology continues to expand its applications metal aircraft and missiles will be seen as a throwback to an earlier era. New techniques call for new skills and computer and materials science now lead the way in aerodynamics. Just as metal planes replaced wire and wood, designers are adjusting to the new realities and possibilities available with computers and composite materials.

Vocabulary

1. resin [`rezɪn] – смола, канифоль
2. fly-by-wire flight control systems – системы дистанционного управления полётами
3. propulsion systems – движительная система, силовая установка
4. embed – заделывать, заливать
5. spar – (авиац.) лонжерон
6. rib – (авиац.) нервюра
7. ally[`ælaɪ] – друг, помощник

Vocabulary development

4.2. Choose the synonyms for the following words.

1. composite a) heavy, b) complex, c) expensive, d) similar;
2. tough a) flexible, b) light, c) innovative, d) strong;
3. maintain a) keep up, b) produce, c) control, d) operate;
4. bond a) connect, b) limit, c) divide, d) separate;
5. property a) shape, b) characteristic, c) material, d) element;
6. fatigue a) accident, b) conception, c) corrosion, d) exhaustion;
7. adjust a) find, b) apply, c) adapt, d) replace;
8. thoroughly a) entirely, b) partly, c) slightly, d) hardly.

4.3. Replace the Russian words with the appropriate English equivalents.

allows fibres tough dense missile generation application expand

1. ***Применение*** of modern methods provides the high speed of the manufacturing process.
2. To follow all the modern trends it is necessary to use extremely ***прочные*** materials.
3. Practically all materials used in production of such components are ***сплавы***.
4. Synthetic ***волокна*** is the integral part of high-strength structures.
5. Oxygen is quite a ***плотный*** gas.
6. Guided ***ракета*** was detected by the air-raid system.
7. The latest ***поколение*** of military aircraft is aimed to protect the aerial frontiers.
8. These technologies continue ***развиваться***.

Comprehension

4.4. Match the beginning of the sentence with its ending.

1. They have produced extremely tough and stable materials…
2. Advances in structural technology have…
3. Until the late 1960s, almost all tactical aircraft…
4. Big advantage of composites is…
5. Computer-aided design (CAD) has made
6. Composites already have had a major impact…
7. Metal aircraft and missiles will be seen…

a)… were composed primarily of aluminum and its alloys.
b)… to develop composite structures. influenced the way.
c)… that are replacing aluminum and aluminum alloys.
d)… aircraft are designed, produced and maintained.
e)… as a throwback to an earlier era it much easier…
f)… that they are relatively insensitive to flaws.
g)… on military aircraft design.

4.5. Answer the questions.

1. What has been changed in modern aircraft due to the advances in technology?
2. What are the drawbacks of using titanium in high-speed aircraft?
3. Will the F-35 joint strike fighter have a composite content of at least 35 per cent or 20 per cent?
4. Composite material is made up of more than three separate components, isn't it?
5. What is Kevlar used for?
6. Are composite materials stable?
7. Why must careful attention be paid to composite/metal interaction in the design process?
8. How can design, production and quality-control personnel take full advantage of the potential of composite materials?
9. Composites haven't been used extensively in the latest generation of aircraft, have they?
10. What do new techniques call for?

Grammar revision

4.6. Name the types of the questions in the previous exercise (general, disjunctive, alternative, special). Choose one sentence in the text and write down four types of questions to it.

4.7. Rewrite the sentences using the Reported Speech.
Example: "The article is not very informative," he said. / He said that the article was not very informative.

1."We mould this material into different shapes," the worker said.
2."Read the instructions before you switch on the machine," he said to me.
3. "The use of aluminum is not irrelevant now," told us the production manager.
4. "Are all modern models of commercial aircraft made of such materials?" the passenger asked.
5. "High resistance to cracking is its main advantage," the engineer explained to us.
6. "How does this mechanism function? "a student asked.
7. "Who is controlling all the process?" he wondered.
8." Some metals will corrode when in contact with carbon fibre," she said.

Speaking

4.8. Summarise the main ideas of the text.

Unit 5

Before you read

5.1. Answer the following questions:
1) What aircraft manufacturers do you know?
2) Have you ever travelled by Airbus airliners?
Do they differ from the other ones? In what way?

5.2. Read the text and speak about innovative technologies that Airbus' manufacturers used.

AIRBUS: PIONEERING LEADERSHIP

Airbus is one of the world's leading aircraft manufacturers, and it consistently captures approximately half or more of all orders for airliners with more than 100 seats.

Over the past 40 years, Airbus has played a key role in the international air transport industry's evolution. Achievements such as improving manu-

facturing techniques, developing global cooperation, and reducing aviation's environmental impact result from Airbus' ability to understand market and passenger expectations, and answer them with solutions that have become world standards.

Airbus always has been forward-thinking, with the environmental impact of its products high on the agenda. Their mission is to provide the aircraft best suited to the market's needs and to support these aircraft with the highest quality of service. The Airbus product line comprises 14 aircraft models, from the 100-seat single-aisle A318 jetliner to the 525-seat A380 – which is the largest civil airliner in service. Reducing noise and fuel consumption – and thus emissions – as well as managing the full lifecycle of its aircraft all are major objectives.

At a time when others were concentrating on three- or four-engine aircraft, Airbus entered the civil aviation scene by developing the first ever widebody twin-engine, the A300B, in the 1970s. This aircraft featured low fuel consumption, reduced external noise levels and highly efficient operating costs, as well as Category 3 landing technology, enhanced comfort and containerized cargo.

In the early 1980s, Airbus improved the A300B with a new concept of forward-facing crew cockpits – which reduced the crew to two pilots while improving safety and introducing new standards for civil aircraft.

Next, it developed a shortened version of the A300: the A310. It was the first commercial widebody to be certified for two-man crew operations from the start, as well as the initial aircraft to use composites for primary structure components.

In the late 1980s, Airbus broke new ground again with the A320 – which set standards for efficiency and cabin comfort, and introduced fly-by-wire flight controls and side-stick controllers into civil aviation.

In the early 1990s, Airbus introduced ultra-efficient aircraft for the medium- and long-range markets: the A330 and A340.

The recent introduction of Airbus' 21st century flagship A380 marked a new era. It is not only setting new passenger comfort standards, the aircraft is raising the bar for environmental standards with its low fuel consumption and noise levels – as well as reduced CO2 and NOx emissions.

The A350 XWB will continue Airbus innovation, utilizing new technologies and advanced materials such as 53 per cent of CFRP (Carbon Fibre Reinforced Plastic) while keeping the benefits of commonality.

Airbus made 483 deliveries in 2008, surpassing the previous year's total by 30. Its total number of aircraft provided to customers worldwide was

above the 5,600 mark as of April 2009, with combined orders reaching more than 9,200 single-aisle and widebody Airbus jetliners. It has also expanded into the military transport aircraft sector.

Finally, Airbus revolutionized the industry by convincing European partners to develop and manufacture aircraft components while assembling the aircraft on a single production line.

To safeguard this technology leadership position and to ensure its global competitiveness, Airbus relies on its ability to innovate and build the world's most efficient aircraft. Today, Airbus 2020 sets the path for a huge R&T programme over the next 20 years, which will ensure that innovation remains at the heart of Airbus development.

Comprehension

5.3. Divide the text into logically complete parts and match them to the headings:

a) Objectives
b) The role in the international air transport industry's evolution
c) Development
d) Future prospects
e) Deliveries

5.4. What do these numbers refer to?

100, 14, 30, 9200, 483, 525, 5600

5.5. Mark each statement as T (True), F (False) or N (Not Mentioned).

1) Airbus is one of the leading aircraft manufacturers in Russia.

2) Airbus has an ability to understand market and passenger expectations and offer a good solution.

3) Aerial tankers for in-flight refueling and transport missions are available in aircraft variants derived from the A310 and A330.

4) The largest civil airliner in service A380 has 500 seats.

5) The A310 was the first commercial widebody to be certified for two-man crew operations.

6) To safeguard technology leadership position and to ensure its global competitiveness, Airbus follows traditional methods without introducing any new technologies

Vocabulary development

5.6. Form the nouns by means of the suffix *tion* and translate them into Russsian. Consult the dictionary if necessary.

1. evolve –
2. expect –
3. solve –
4. operate
5. introduce –
6. innovate –
7. consume –
8. cooperate –

5.7. Match the pairs of synonyms.

A	**B**
1. enhanced	a. cabin
2. utilize	b. reinforced
3. commonality	c. expectation
4. anticipation	d. use
5. cockpit	e. community
6. ensure	f. secure
7. safeguard	g. guarantee
8. approximately	h. about

5.8. Match English words to their Russian equivalents.

широкофюзеляжный сдвоенный двигатель; дальновидный; сказать новое слово; выйти на арену гражданской авиации; узкофюзеляжный реактивный самолет; воздействие на окружающую среду, боковая ручка управления.

5.9. Match the words in A to the definitions in B

A	**B**
1. fly-by-wire	a. the act of bringing goods, letters, etc. to a particular person or place.
2. to capture	b. to include or show smth. as a special or important part of smth.
3. flagship	c. operated by electronic circuits rather than mechanical rods
4. to feature	d. to get control of a place or object
5. delivery	e. to be even better or greater than smb. or smth. else
6. to surpass	f. the best and most important product that a company owns or produce

Grammar revision

5.10. Translate the sentences paying attention to the use of the Infinitive. Define its function.

1. To support its growth, Airbus has developed a logistics system to move components over Europe using the specially-designed cargo aircraft, ships and road transportation vehicles.

2. Airbus continues to pioneer with the opening of the A320 Final Assembly Line China (FALC) in Tianjin last year, a clear sign of its innovative approach to international cooperation.

3. Airbus has been built on its ability to draw on the best of Europe and develop innovative products in anticipation of market needs.

4. Airbus' vision for 2020 is to be a top-performing enterprise building the world's best aircraft for its customers.

5. Their mission is to provide the aircraft best suited to the market's needs and to support these aircraft with the highest quality of service.

6. To safeguard this technology leadership position and to ensure its global competitiveness, Airbus relies on its ability to innovate and build the world's most efficient aircraft.

Compiled by Kondratyeva O. I. (Units 2–4),
Serguntsova A. S. (Unit 1)

MODULE II

Faculty of Applied Mathematics and Computer Science

Unit 1

Before you read

1.1. Answer the questions.

1. How many departments does the faculty of Applied Mathematics, Computer and Information Science comprise?
2. When was this faculty founded?
3. What subjects do students study at this faculty?
4. What facilities does it provide students with?

1.2. Now you study at NSTU and in some years you will be a qualified specialist. You have chosen to study at this faculty. What do you know about your faculty?

1.3. Read the text.

THE FACULTY OF APPLIED MATHEMATICS, COMPUTER AND INFORMATION SCIENCE

After completing school it was not an easy decision for some school leavers to come to the Faculty of Applied Mathematics, Computer and Information Science at the Novosibirsk State Technical University.

Admission to NSTU and to this faculty is open to all but it is more selective than admission to some other faculties. But for many people this decision does often prove to be a winning one. They successfully pass their entrance exams and are enrolled.

Now they are in the first year of study and are very pleased that they chose this faculty because mathematics, computer science and information technologies are still a new and challenging area and the faculty has quite a reputation for it. Besides, students are promised that the faculty would take great care to ensure smooth transition from school to university.

The faculty was set up in 1993 and at present comprises seven departments. The major are the Department of Applied Mathematics; Software Systems and Databases; Parallel Computational Technologies; Computational Technologies.

The faculty offers **Bachelor's degree** in applied mathematics and computer science, **Engineer's degree** in applied mathematics, and **Master's degree** in applied mathematics and computer science, mathematical modeling and computer software.

In accordance with the curriculum, students are given fundamental training in the field of up-to date computational and information technologies, they acquire techniques of development and implementation of up-to-date software, and skills in working and programming in different operational environments, study algorithmic and databases languages.

The faculty courses are taught by the academic staff with a background in pure and applied mathematics as well as in the computer science and information technologies. All the staff also combine teaching with research work.

The range of subjects taught gives an opportunity to major in a wide variety of directions, which are computer graphics; network information technologies; artificial intelligence systems; up-to-date technologies of computer data analysis and optimal experimental design; computational methods for solving problems of mathematical physics; application of mathematical methods to finance and insurance.

The faculty has extensive facilities, that is, many modern computers, fully equipped computer classrooms. They are supported and supplemented by the University Network offering full Internet access to facilitate students work and study.

Comprehension

1.4. Read the text and decide if the statements are true (T) or false (F).

1. The faculty was set up in 1992.
2. Admission to this faculty is not open to all people.
3. The faculty offers Bachelor's degree in applied mathematics and computer software.
4. At present the faculty comprises seven departments.

Vocabulary development

1.5. Match the words to make pairs of antonyms.

1. pass an exam	a. complicate
2. entrance exams	b. fail an exam
3. to be enrolled	c. limited
4. facilitate	d. final exams
5. extensive**.**	e. to be expelled

1.6. Match the words to make up word combinations.

1. to pass	a. a faculty
2. to choose	b. degree
3. to comprise	c. departments
4. to offer	d. an exam

1.7. Read the sentences and choose the right translation for the words in bold.

1. The faculty has **fully equipped** computer classrooms. (хорошо оборудованные, полностью обставленные).

2. After completing school it was not an easy decision for some **school leavers** (школьников, выпускников школ) to come to NSTU.

3. They successfully pass their **entrance exams** (выпускные экзамены, вступительные экзамены) and are enrolled.

4. The faculty **was set up** (был основан, был установлен) in 1993.

1.8. Fill in the gaps with the words from the text.

1. Admission to this faculty is more ….. than admission to some other faculties.

2. At present the faculty comprises seven …..

3. All the staff ….. teaching with research work.

4. In accordance with the ….., students are given fundamental training in the field of up-to-date computational and information technologies.

5. The range of subjects taught gives an opportunity to ….. in a wide variety of direction.

1.9. Choose the right answer.

1. The faculty was set up in ….

a) 1992
b) 1993
c) 1995
d) 1990

2. The faculty comprises … departments.	a) 7 b) 6 c) 3 d) 4
3. Students can get Master's degree in mathematical … and computer software.	a) construction b) analysis c) modeling d) programming
4. The faculty courses are taught by highly-qualified … staff.	a) academic b) educational c) teach d) scientific
5. Full Internet access is offered to … students work and study.	a) reduce b) increase c) complicate d) facilitate

1.10. Choose the right word to complete the sentence.

1. Admission to NSTU and to this faculty is more selective/ selectively than admission to some other faculties.
2. They successful/ successfully pass their entrance exams and are enrolled.
3. The faculty has extensive/ extensively facilities.
4. The faculty has full/ fully equipped computer classrooms.
5. They are supported by the University Network offering full/ fully Internet access.

1.11. Put the verbs in the correct form.

1. A lot of people who successfully pass their entrance exams … (enroll) at the University.
2. The faculty courses … (teach) by an academic staff with a background in applied mathematics.
3. The faculty … (offer) Bachelor's degree, Engineer's degree and Master's degree in applied mathematics.
4. The equipped computer classrooms … (support) by the University Network.

5. All the staff … (combine) teaching with research work.

6. Students … (give) fundamental training in the field of information technologies.

7. Students acquire skills in … (work) and … (program) in different operational environments.

8. One of directions for students to choose is computational methods for … (solve) problems of mathematical physics.

9. It was not an easy decision for some school leavers … (come) to the faculty of Applied Mathematics.

Speaking

1.12. a)Why have you chosen this faculty? Why do you like it? What would you change in the curriculum of your faculty? Discuss in pairs.

b) Speak about the faculty of Applied Mathematics, Computer and Information Science using the information from 1.3.

Unit 2

Before you read

2.1. Discuss these questions with your partner.

a) Why do people study Maths?

b) Where and when do you use it?

2.2. Decide if the following statements are *true* or *false*.

1 The word *mathematics* comes from British English.

2 Mathematics developed in complexity due to a need to understand the relationship between things.

3 The Incas were the first to come up with a number system.

4 Mathematics is an international language because it uses Arabic numerals.

5 Opinions are divided over whether mathematics is truly scientific.

6 The development of mathematics is dependent on other sciences.

2.3. Read the text and check you answers.

FROM THE HISTORY OF MATHEMATICS

The English word *mathematics* tells us something about the influence the Ancient Greeks had on our knowledge. The word comes from the Greek for science, learning and knowledge. It is usually shortened to maths in British English and to math in the USA.

Mathematics developed from a series of ideas, each new idea building on earlier ones. Each new idea became more complex as mathematicians tried to explain how things in the world relate to one another. The first idea to have developed was certainly that of number. People needed to count their belongings. As society developed, numbers became more and more important for business dealings and taxation and it became especially important to be able to record numbers. A wide variety of systems for recording numbers developed in different parts of the world. One example is the tallies that were used by the Incas in South America. They used pieces of string of different lengths and by tying knots in different places along the string, they were able to keep tax records and business accounts throughout their land.

With writing, different ways of recording numbers developed in different countries, too. Roman numerals are a well-known example. In this system I is one and X is ten, so IX is one before ten, that is nine, and XI is eleven. It was not until the 16^{th} century that the system of mathematical notation that we use today finally developed. It is a system that uses Arabic numerals (1, 2, 3 and so on) with a set of symbols + (plus), – (minus), = (equals) for example, along with letters, many of which are taken from the Greek alphabet. It is a system which is used by all mathematicians all over the world. In fact, it has been said that mathematics is one of only two genuinely international languages; the other one is music.

Whether or not mathematics is a science is still a matter of opinion. No one can set up an experiment to prove that one plus one is two without counting. Therefore, because it cannot be proved by experiment, mathematics is not a science. Others say yes, it is, because science is the search for knowledge and that is what mathematics does. Therefore, mathematics is a science.

Whatever your point of view, there is not doubt that mathematics is applied to all sciences. Many of the most important developments in fields such as physics or engineering have led to further developments in mathematics. The argument over whether mathematics is a science or not appears to be unimportant when you realize that it is impossible to separate mathematics from science or science from mathematics. Many universities recognize this. In many places of learning there are divisions of study, often called Mathematics and Science. The unbreakable connection between mathematics and all other sciences is recognized by the very way in which we study them.

Comprehension

2.4. Complete the sentences.

1 The word *mathematics* is usually shortened to …
2 Mathematics tried to explain …
3 Numbers became more and more important for …
4 Science is the search for …
5 Mathematics is applied to …
6 It is impossible to separate mathematics from …
7 There are divisions of study in many places of learning, often called …

Vocabulary development

2.5 Match these words with their definitions.

1. division	a. a system of figures or symbols, representing numbers
2. knot	b. a written sign in maths or music, for example, which represents an operation, an element, relation, etc.
3. to set up	c. a record of money spent or received
4. numeral	d. a separation
5. symbol	e. to make ready for operation
6. tally	f. a symbol representing a number
7. notation	g. tie, bond

2.6 Fill in the gaps with the words from the box.

division	knots	set up	numerals	
symbols	notation	tally		

1. If you keep a _____, you have a system to note how much has been spent.
2. The Roman _____ are still used as numbers nowadays.
3. There is a _____ between science and art subjects.
4. In maths we use _____ to show what kind of problem we are solving.
5. _____ in maths are things like numerals.
6. Some people tie _____ to remember something.
7. She _____ an experiment.

Grammar revision

2.7. Put the verb in brackets into the correct form of the Participle.

1 Numeral is a system of figures or symbols (to represent) numbers.

2 (to calculate) the distance, he solved the task.

3 There are various ways of recording numbers (to develop) in different countries.

4 You can do some arithmetic sums (to use) computer.

5 (to measure) the angles of triangle, he showed results to the engineer.

6 The results (to receive) were of great importance.

7 He thought about the problem (to discuss) at the conference.

2.8. Translate the sentences using *Complex Object* or *Complex Subject*.

1. Я знаю, что факультет прикладной математики является одним из самых престижных.

2. Считается, что арабские цифры используются по всему миру.

3. Кажется, математика была его любимым предметом в школе.

4. Я слышал, что она проводила эксперимент два года назад.

5. Оказалось, что они использовали новые методы в работе.

6. Так случилось, что эти ученые работают над одной проблемой.

7. Сообщили, что все вычисления являются неверными.

Speaking

2.9. What other interesting facts from the history of the maths do you know?
Prepare a short report about at least one and deliver it to your class-mates.

Unit 3

Before you read

3.1. Match these words with their definitions.

1. to arise	a. to make better
2. to refine	b. to allow
3.to exclude	c. to occur
4. to simplify	d. to leave out
5. adjustments	e. understandable
6. comprehensible	f. small changes
7.to enable	g. to make something easier to do or understand

3.2. Fill in the gaps with the words 1 to 7 in the correct form from 3.1.

1. Computerisation should _____ to cut production costs by half.
2. Are there any matters _____ from the last meeting?
3. Could you _____ what you have just said?
4. I don't think we can _____ the possibility that this prediction is incorrect.
5. She made a few minor _____ to the device.
6. The new computer software is highly _____ and can do much more than the old version.
7. It's written in clear, _____ English.

3.3. Read the text. Then put the events (A-F) below in the correct order to show the procedure for using applied mathematics.

A The revised model is applied.
B The model is adjusted.
C A mathematical model is created.
D A problem arises.
E A solution is found.
F Approximate solutions are obtained.

APPLIED MATHEMATICS

When mathematics is used to solve problems in some related areas of life, it is known as applied mathematics. Applied mathematics provides us with answers and solutions. It is used in numerous ways. A few examples are numerical analysis, engineering and programming. In these and other areas, applied mathematics takes problems from real life, and gives us successful and creative tools for solving them. Often, the first step when using applied mathematics is to create a mathematical model. This is a description of the problem in mathematical terms. This model is then studied to obtain exact or approximate solutions. If the solution is exact, the model is applied to the problem; if it is approximate, the model is refined until it is exact. Then, conclusions are interpreted and explained in comprehensible terms. Often the model is changed to be more realistic. So the modeling process may involve many adjustments. The second stage is the final solution to the problems mathematically formulated in the first stage.

It is often not clear which mathematical tools will be useful in the study of a new problem, for example, algebra or differential calculus. For this reason, applied mathematicians need to be well trained in a range of mathematical areas so they will have a wide variety of mathematical tools available to

them. They must not only be skilled mathematicians but must also be knowledgeable in the specific area to which mathematics is being applied. For example, in dealing with business and industry, knowledge of economics is necessary.

When it comes to creating models, the mathematician will make choices about which factors to include and which to exclude. The goal is to produce a model that is realistic enough to reflect the main aspects of the problem being studied, but simple enough to be treated mathematically.

Sometimes the mathematician has to either simplify this model so it can be analysed, or devise new mathematical methods that will allow the model to be analysed. Problems sometimes lead to new mathematical methods, and existing mathematical methods often lead to a new understanding of the problem.

Vocabulary development

3.4. Listen to a course director giving some information to a group of potential maths students. Then decide if the following statements are *true* or *false.*

1. Mathematics is an expanding area with good job prospects.
2. The difference between pure and applied mathematics lies in the content of the studies.
3. An applied mathematician finds answers to questions raised by mathematics.
4. A pure mathematician's answers take the form of general propositions with exact , formal proof.
5. The two kinds of mathematics can come to the same conclusions.

3.5. Fill in the table.

Verb	Noun	Adjective
exclude		
simplify		
	adjustment	
analyse		
		comprehensible
provide		
reflect		
apply		

3.6. Fill in the gaps with the words from 3.5.

1. The teacher's _____ of the argument helped the students to understand it.
2. The new statistics course is much more _____ – certainly not as theoretical as the one I did.
3. The students seemed to be struggling to _____ but their knowledge of French was too poor.
4. There are several _____ from the names put forward to be considered for the job.
5. The _____ of modern information technology will be essential for developing the area.
6. Some students have a more _____ approach to learning.
7. This mistake is a _____ of your relaxed attitude to learning.
8. The height of the steering wheel is _____, and seating is comfortable and supportive.

3.7. Fill in the gaps with the correct prepositions.

1. There are no simple solutions ___ the problem, but our well trained specialists are analyzing the situation.
2. How do you intend to deal ___ the modeling process at this stage.
3. When it comes ___ interpreting our findings, we should be extremely careful.
4. It is vital that IT is made available ___ all students of the university.
5. Before you start to analyse the model, make sure that you are provided ___ all the necessary data.
6. Years of painstaking research have led ___ a new much more durable material.
7. The task was explained ___ comprehensible terms to avoid misunderstanding.

3.8. Fill in the gaps with the following words to make *well+Past Participle* constructions.

balanced	known	travelled	documented	
groomed	chosen	attended	mannered	qualified

1. The information was given at an unusually well-_____ press conference yesterday.
2. A person who is well-_____ is calm and reasonable, and acts in a way that shows good judgement.

3. He introduced his speech with a few well-_____ words.
4. He is the sort of well-_____ man you expect to inhabit an executive-size corporate office.
5. He has more that ten years of experience in applied mathematics behind him, so he is well-_____ to offer advice.
6. She knows a great deal about different cultures. She is extremely well-_____.
7. You must have read his articles. He is a very well-_____ scientist.
8. You can introduce him to anyone and he won't let you down. He is extremely well-_____.
9. You can find out everything about the development of the Internet. It is very well-_____.

Speaking

3.9 Discuss the questions with your partner.

a) What is the goal of applied mathematics and what are the steps of achieving it?

b) What role will applied mathematics play in your future work?

Unit 4

Vocabulary development

4.1. Match a word in A with a word in B. Write one sentence with each word partnership.

A	B
1. information	a. system
2. business	b. programs
3. satellite	c. technology
4. numerical	d. interface
5. debugging	e. transaction
6. graphical	f. simulation

4.2. Fill in the gaps with the following words.

diverse challenging major handicapped ever-growing crucial

1. What is the best way for improving theatre access for people who are physically _____.

2. This will be a _____ decision for the education services because it sets the standard for all future years.
3. This _____ article is one of the most thought-provoking that I've ever read.
4. Students from countries as _____ as Colombia and Finland use these textbooks when they learn English.
5. There are two problems with this device, one _____, one minor.
6. He has an impressively _____ range of interests and experience.
7. The _____ use of computers makes our life more and more dependent on them.

4.3. Read the text and give a heading to each passage of the text.

ADVANCING IT PROFESSIONALS. SIMULATION SOFTWARE

Working with computers and information technology can be both exiting and challenging. Computers are concerned primary with the processing of information, which is found in many forms including information required for business transactions, information on materials and products made during the manufacturing processes, or information required to monitor and control the operation of complex processes of satellite systems. Computers also may be used to control devices which help the physically handicapped, or to provide detailed maps of land use from information collected by satellite observation. The effective use of information has become crucial in the management of most businesses and industries. Consequently, information is now regarded as a major resource, just as people are an important resource, in most enterprises.

IT professionals have a crucial and challenging part to play in the effective application of computers and computing technology. The ever-growing list of activities to which computing is applied can impress everybody. Most professional IT work can be classified into three broad areas: information systems, computer engineering and computer science. Information systems area is engaged with designing and implementing systems which collect, validate, store and report information from customers or other business transactions. IT professionals in the computer systems engineering are involved in the application of computer in a wide range of industrial control. Computer systems of this type require the design of special computer hardware, and the writing of specialized software to interact with the industrial

control systems. The third main area of interest is undertaking research into the design of specialized hardware or software.

Writing a computer program to carry out numerical simulations can be daunting for those without experience in programming and numerical methods; even for those with experience, the drudgery of writing data entry, and the usual exasperation of debugging programs, may be enough to scuttle a simulation project. Fortunately, today there are software packages to make simulations not only easier but fun. To understand what simulation software is, it is important to understand the simulation software is different from equation-solving ware. Simulation software allows the user to describe a complex system in bits and pieces, to draw a block diagram of the system on the computer screen, and to observe how the variables of the model change over time.

4.4. Which word is similar in meaning to the underlined word in each extract?

1. … systems which collect, validate, store and report information from customers or other business transactions.

a) to change b) to make smth approved c) to challenge

2. Writing a computer program …….. can be daunting for those without experience ….

a) discouraging b) stimulating c) entertaining

3. … even for those with experience, the drudgery of writing data entry ….

a) important work b) work that needs great accuracy c)hard boring work

4. … and the usual exasperation of debugging programs …

a) much pleasure b) surprise c) extreme annoyance

5. … may be enough to scuttle a simulation project.

a) to move quickly b) to enjoy a lot c) to improve

6) … and observe how the variables of the model change over time.

a) smth that changes frequently b) smth that is stable c) differences

4.5. Match the words to their definitions.

a) gadget b) hardware c) appliance d) engine e) device f) equipment

1. A machine, usually one that is electrical that is used for doing jobs in the home, such as washing clothes or cooking food.

2. All the special tools, machines that you need for a particular activity or purpose.
3. A small rather unusual, and cleverly designed tool that is not really necessary but is useful because it allows you to do smth more easily.
4. A small, usually simple, but very well-designed tool, that is very useful and helpful, especially advanced electronic equipment.
5. Computers and other machines connected to them.
6. The part of a machine such as a car, train or plane that makes power from petrol, steam etc and turns it into movement.

4.6. Fill in the gaps with the words from 4.5.

1. Many of the labour-saving _____ which we all take for granted today did not exist before the war.
2. Some brand new special _____ for post graduate use is available in the laboratory.
3. Every time I try to start the _____ of my car it makes the strange knocking sound.
4. Her kitchen was full of all the latest household _____ – electric can-openers, talking timers, etc.
5. The growing complexity of computer _____ and operating systems often makes more likely to break down.
6. Most homes now have numerous domestic _____, from dishwasher to microwave ovens.

4.7. Choose the correct word from the box to complete the sentences.

Increasing	frost	green	present	lasting

1. The ever-_____ demand for private cars could be decreased by more investment in public transport.
2. Bug is the ever-_____ threat for any Internet user.
3. The leaves of ever_____ trees are often shaped like needles.
4. Their contributions to science have earned them an ever_____ place in history.
5. The climate in this area is severe and ever_____ does not allow the population to grow vegetables.

4.8. Some words in the text should not be there. Tick each correct line. If a line has a word which should not be there, write the word in the space.

The Electronic Age

I recently learned how to use a computer, and I have many friends who they play computer games at home.	1) they
However, although recently I have begun to worry	2)_____
that in nowadays we rely too much on electronic gadgets.	3)_____
Once before people managed to write and think using	4)_____
their brains, but now many people have become so	5)_____
accustomed to using machines, so that they can't do	6)_____
anything without them. There are many people who	7)_____
they depend on electronic gadgets completely. For	8)_____
an instance, many of my friends sit at home in the	9)_____
evening and watch television, and instead of going	10)____
out so to meet people. I think that this makes everyone	11)____
feel more lonely, even though they learn a lot about	12)____
people all over in the world. Of course there are many	13)____
electronic gadgets that save us time, though not all	14)____
of them are really necessary. I am in favour of some	15)____
gadgets, but I am against of having everything in life	16)____
depending on pushing a button.	

Unit 5

Before you read

5.1. Decide whether the statements are *true* or *false.*

1. The world population will double by the year 2600.
2. Earth is far from being the most favoured planet in the solar system.
3. Human DNA is impossible to change.
4. No government can prevent genetic engineering on humans.
5. Electronic systems will never be more complex than biological ones.
6. If people are intelligent enough they can design computers that are more intelligent than humans.
7. Professor Stephen Hawking is sure that any aliens will consider our planet to be advanced.

5.2. Read the text and check your answers.

A BRIEF HISTORY OF THE FUTURE

Will we colonise the universe? Are aliens out there? Can computers outsmart us? In a unique interview, Professor Stephen Hawking, who has spent a lifetime applying his formidable intellect to the big questions, gives his predictions for the human race.

In Cambridge University's Department of Applied Mathematics and Theoretical Physics Hawking holds the professorial chair once held by Isaac Newton. He tells us what he thinks the future has in store for the human race.

If the world population continues to grow at its present rate – doubling every 40 years – there isn't going to be enough room for us all on Earth by the year 2600. So will we be able to spread out to other planets?

"We shall probably manage a manned or, should I say, personned, flight to Mars in the next century. But Earth is by far the most favoured planet in the solar system. Mars is small, cold and without much atmosphere, and the other planets are quite unsuitable for human beings. We either have to learn to live in space stations or travel to the next star. We won't do that in the next century."

Will we humans keep on changing, or will we eventually reach an ultimate level of development and knowledge?

"In the next 100 years or even in the next twenty, we may discover a complete theory of the basic laws of the universe, but there will be no limit to the complexity of biological or electronic systems we can build under these laws. By far the most complex systems we have are our own bodies. There haven't been any significant changes in human DNA in the past 10,000 years. But soon we will be able to increase the complexity of our internal record, our DNA, without having to wait for the slow process of biological evolution. It is likely that we will be able to redesign it completely in the next 1,000 years – by increasing our brain size, for example. Of course, many will say genetic engineering on humans will be banned but I rather doubt that they will be able to prevent it. Genetic engineering on plants and animals will be allowed for economic reasons and someone is bound to try it on humans – unless we have a totalitarian world order, someone will improve humans somewhere.

"We need to become more complex if biological systems are to keep ahead of electronic ones. At the moment computers have an advantage of speed but they show no sign of intelligence. This is not surprising as our present computers are less complex than the brain of an earthworm, a spe-

cies not known for its intellectual powers. But computers' speed and complexity double every eighteen months and this will probably continue until computers have a similar complexity to the human brain."

Will computers ever show true intelligence, whatever that might be?

"It seems to me that if very complicated chemical molecules can operate in humans to make them intelligent, then equally complicated electronic circuits can also make computers act in an intelligent way. And if they are intelligent, they can presumably design computers that have even greater intelligence and complexity."

Will we make contact with aliens in the next millennium?

"Even if life developed in other stellar systems, the chances of catching it at a recognizably human stage are very small. Any alien life we encounter will be much more primitive or much more advanced than us. And if it is more advanced why hasn't it spread through the galaxy and visited Earth? It could be that there is an advanced race out there which is aware of our existence but it is leaving us to stew in our own primitive juices. However, I doubt they would be so considerate to a lower life form. Some people believe that the reason we have not been contacted is that when a civilization reaches our stage of development it becomes unstable and destroys itself. But I'm an optimist. I think we have a good chance of avoiding nuclear war and Armageddon."

Vocabulary development

5.3. Match the words in A to the words in B.

A	B
1. hold	a. predictions
2. have in	b. your own juice
3. stew in	c. genetic engineering
4. give	d. a chair
5. ban	e. any alien life
6. encounter	f. store

5.4. Fill in the gaps with one of the following words with the prefix <u>out</u>~ or <u>re</u>~.

Built weigh construct last performed cycle charge run

1. The Peugeot engine has consistently _____ its rivals this season.
2. In the future, demand for metal like tungsten will _____ supply.

3. We know these chemicals are dangerous, but their benefits far _____ any risk to the environment.
4. A plastic casing will usually _____ a leather one.
5. He bought a vintage car and completely _____ the engine.
6. An electric car needs to have its battery _____ approximately every 150 kilometres.
7. We have no computer backup and had to rely on old paper files to _____ the records.
8. Companies are now trying to _____ their waste or find other ways of disposing of their by-products.

5.5. Fill in the gaps with the correct preposition.

1. If you apply yourself ___ something, you work hard at it, directing your abilities and efforts in a determined way so that you succeed.
2. The government's prediction ___ unemployment made them think about some part-time sideline.
3. ___ reasons no one else knows about he's decided to leave his job.
4. This brand is known ___ reliability and durability of their products.
5. Their design was similar ___ ours so we suspected them of industrial espionage.
6. Can we expect an advanced alien race to be considerate ___ us?

Speaking

5.6. Discuss with your partner the questions from the text. Report the results of your discussion to your classmates.

Compiled by Kaminskaya E. V. (Unit 2),
Telengator A. A. (Units 1, 3, 4)

MODULE III

Faculty of Automation and ComputerEngineering

Unit 1

Before you read

1.1. Discuss these questions with your partners.

1. What do you know about your faculty?
2. Why have you chosen this faculty?
3. Who recommended you to enter this faculty?
4. What entrance exams did you take?

1.2. Read the text. Make a list of the facts that are new for you. Compare your list with a partner.

FACULTY OF AUTOMATION AND COMPUTER ENGINEERING

The Faculty of Automation and Computer Engineering is one of the largest NSTU faculties. The faculty was set up in 1963. It comprised three departments at that time. These were the Department of Automation and Teleautomatics; Electric Metering Technology; and Mathematical and Calculating Machines and Devices.

Since 1994 the Faculty has been located in the seventh teaching block, being the only faculty occupying a separate building.

At present the faculty comprises six major departments awarding degrees. These are the following ones: Department of Automation; Department of Instrumentation; Department of Automated Control Systems; Department of Computer Engineering; Department of Data Collection and Data Processing Systems; Department of Network Information Technologies.

Students are given an opportunity not only to obtain the most up-to-date knowledge in the area chosen, but also to carry out research and participate

in engineering developments. The Faculty has about 40 instructional and research laboratories and computer classrooms, among these are "SIEMENS" training centre and "AEG-Modicon-Schneider" training centre.

The Faculty offers multi-level system of training awarding Bachelor's, Master's and Engineer's degrees. The Bachelor degree is awarded after 4 years of study, Engineer's degree- after 5.5 years, and Master's degree- after six years of study.

The teaching staff are 110 teachers and professors. The faculty offers Bachelor's and Master's degrees in the fields of automation and control; instrument engineering; information science and computer engineering; and biomedical engineering. An Engineer's degree is awarded in the fields of biotechnical and medical apparatuses and systems; control and informatics in engineering systems; off-line information and control systems; computers, complexes, systems and networks; computer-aided data processing and control systems; computer-aided design systems; software for computer technology and computer-aided systems; computer-aided systems of information security.

More than 150 international students study at the Faculty.

Students acquire fundamental knowledge and practical training in various fields of science and engineering related to data processing, theory of control, design of various instruments and devices.

Vocabulary

1. faculty – факультет
2. automation – автоматика
3. computer engineering – вычислительная техника
4. Instrumentation department – кафедра Приборостроения
5. automated control system – автоматизированная система управления
6. data collection – сбор данных
7. data processing system – система обработки данных
8. network information technologies – технологии информационных систем
9. to be set up – быть основанным
10. to be located in – быть расположенным, находиться
11. teaching block – учебный корпус
12. teaching staff – преподавательский состав
13. computer-aided data processing – автоматическая обработка данных

14. system of information security – система информационной безопасности
15. instructional laboratory – учебная лаборатория
16. technologist – технолог
17. technique – техника, технические приемы
18. computing machinery – вычислительная техника
19. graduate students – магистранты
20. design – чертеж, проект; проектировать

Vocabulary development

Match the English phrases and their opposites.

1. to graduate from the University	a) research-oriented
	b) to enter the university
2. to fail the exams	c) multi-level education scheme
3. minor	d) major
4. career-oriented	e) to pass the exams
5. one-level education scheme	

1.4. Make up all possible word combinations.

1. centre	a) year
2. scientific	b) laboratory
3. instructional	c) system
4. mechanized	d) machinery
5. academic	e) students
6. computing	f) experiment
7. graduate	g) device

Comprehension

1.5. Decide if the statements are true(T) or false (F)

1. The faculty was set up in 1996.
2. The teaching staff are 110 teachers and professors.
3. Students are given an opportunity to obtain the most up-to-date knowledge in the area chosen.
4. Since 1994 the faculty has been located in the sixth teaching block.
5. The faculty comprises six major departments awarding degrees.

1.6. Answer the questions on the text.

1. Where is the Faculty of Automation and Computer Engineering located?

2. When was the faculty set up?
3. How many teachers and professors work at the faculty?
4. Who can study at the faculty?
5. Who is the dean of the faculty? When did he take office?
6. What system of training does the faculty offer to their students?
7. How long should the students study to get a Bachelor's degree,a Master's degree and an Engineer's degree?
8. Where do the students of the faculty have practical training?
9. Where are you going to work after graduating from the University?

1.7. Find English equivalents to the following sentences in the text.

1. Факультет автоматики и вычислительной техники – один из крупных факультетов в НГТУ.
2. Кафедра автоматизированных систем управления и кафедра компьютерной инженерии находятся в седьмом учебном корпусе.
3. Сейчас на факультете шесть кафедр.
4. Факультет имеет около 40 научно-исследовательских лабораторий и терминальных классов.
5. Более 150 иностранных студентов учатся на факультете.
6. Степень Бакалавра присваивается после 4 лет обучения.

1.8. Translate into English.

1. История факультета начинается с приема студентов в НГТУ с 1 сентября 1958.
2. Кафедра предлагает Степени бакалавра в области информационной науки и компьютерной инженерии.
3. Полученная квалификация помогает выпускникам факультета находить хорошие рабочие места.
4. Кафедра компьютерной инженерии была основана в 1961 и называлась Кафедрой Математических и Вычислительных Машин и Устройств.
5. Факультет расположен в 7 учебном корпусе.
6. Студенты приобретают фундаментальные знания и практическую подготовку в различных областях науки.

1.9. Put the words in the proper order to make sentences.

1. Control Systems, The, is Automated Data Processing, of, one of the most, and, up-to-date, direction, of, training, field.
2. Teleautomatics, in, Department, was, 1966, as, of, Automation, and, established, the Department.

3. Memory systems, and, graduates, design, and, manufacture, central processing, units, peripheral, can, devices, Its.

4. The, field, Besides, expanding, departments, give, in, area, thus, training, student's, additional, major, some.

6. And, institutes, offered, graduates, are, work, in, research, offices, design, laboratories, The.

1.10. Fill in the gaps using the words from the box.

Control Systems	field	Microprocessor	methods	subjects
Bachelor's	automatic control systems		Department	
combines	software	Master's	production	Electronics

DEPARTMENT OF AUTOMATION

1._____was established in 1966 as the Department of Automation and Teleautomatics. The Department awards 2. _____ and 3. _____ degrees in the field of Automation and Control.

Automation and Control is a 4. _____of science and technology which 5. _____ an aggregate of facilities, 6. _____, and techniques for human activity created for automatic control of 7. _____ lines and processes, mobile objects, off-line multivariable engineering, administrative, financial, and other systems.

Information, databases, local computer network, algorithm, feedback, optimization, and adaptation are the key ideas of the modern science of control and 8. _____, computers, electronic and microprocessor devices, automatic controllers are the basic concepts of automatic control technology. These components form the 9. _____.

Major 10. _____ taught are: Higher Mathematics and Advanced Calculus; Physics; Information Science and Programming; 11. _____ and Circuit Engineering ; 12. _____ and Computer Technology; Automatic Control Theory and Simulation; Information Technologies; Design of Automatics Systems and Facilities; 13. _____and Mathematical Modeling; Statistical Estimation.

1.11. What do these dates refer to?

1994 1961 1958 1966 1963

Grammar revision

1.12. Find the Perfect Active and Passive forms in each line.

1. a) are determining, b) determined, c) has been determined
2. a) have furnished, b) is being furnished, c) furnish
3. a) turn, b) were turning, c) has turned
4. a) is meeting, b) will have met, c) are being met
5. a) had refused, b) refused, c) refuse
6. a) had been offered, b) offered, c) shall offer
7. a) was discovered, b) has been discovered, c) discovers
8. a) are following, b) will follow, c) had been followed

1.13. Match the correspondent forms of the verbs.

to write	gave	written
to speak	met	left
to go	left	read[e]
to see	read [e]	given
to be	went	met
to give	saw	spoken
to leave	spoke	gone
to read [i:]	wrote	been
to meet	was/were	seen

1.14. Open the brackets and put the verbs in the appropriate tense - aspect forms.

1. This book (to write) by Gubarev V. V. in 2005.
2. The faculty (to offer) Bachelor's and Master's degrees.
3. I'm (to study) at the faculty now.
4. After graduating from the university, she (to start) working for Microsoft Company.
5. Students (to give) an opportunity to obtain the most up-to-date knowledge in the area chosen.
6. We (to study) at this faculty for three years.
7. The results of my examinations (to know) tomorrow.
8. Since 1994 the Faculty (to locate) in the seventh teaching block.
9. She (to use) a computer without asking her teacher again.
10. By the end of June we (to study) at the faculty for a year.

Speaking

1.15. Discuss the main ideas of the text in class.

Unit 2

Before you read

2.1. Read the following words, pay attention to their pronunciation:

antiquity
mechanical calculator
machine
predecessor
technology
expert
mathematical

2.2. Match the words to their Russian equivalents

1. field of study
2. antiquity
3. become available
4. abacus
5. constrain
6. initially
7. application
8. punch-card machine
9. mathematical calculation
10. to be in developmental stages
11. predecessor
12. difference engine
13. predate
14. mechanical calculator

a) перфокарточная машина, *выч.* счётно-аналитическая машина
b) в начальной стадии, в начале; в исходном положении
c) математический расчёт
d) быть в стадии развития
e) предшественник; предок;
f) применение
g) разностная машина
h) стать доступным
i) область исследования
j) античность
k) счёты
l) ограничивать
m) предшествовать во времени, появиться раньше чего –либо
n) механический вычислитель; механический вычислительный прибор

2.3. Think of some famous people and their contribution to computer science. Read the text and say what new names and facts you have found.

ON HISTORY OF COMPUTER SCIENCE

The early foundations of what would become computer science predate the invention of the modern digital computer. Machines for calculating fixed numerical tasks, such as the abacus, have existed since antiquity. Wil-

helm Schickard built the first mechanical calculator in 1623.Charles Babbage designed a difference engine in Victorian times helped by Ada Lovelace. Around 1900, punch-card machines were introduced. However, all of these machines were constrained to perform a single task, or at best some subset of all possible tasks.

During the 1940s, as newer and more powerful computing machines were developed, the term ***computer*** referred to the machines rather than their human predecessors. As it became clear that computers could be used for more than just mathematical calculations, the field of computer science broadened to study computation in general. Computer science became a distinct academic discipline in the 1950s and early 1960s.The first computer science degree program in the United States was formed at Purdue University in 1962. Since practical computers became available, many applications of computing have become distinct areas of study in their own right.

Although many initially believed it was impossible that computers themselves could actually be a scientific field of study, in the late fifties it gradually became accepted among the greater academic population. It is the now well-known IBM brand that formed part of the computer science revolution during this time. IBM (short for International Business Machines) released the IBM 704 and later the IBM 709 computers, which were widely used during the exploration period of such devices. "Still, working with the IBM [computer] was frustrating if you had misplaced as much as one letter in one instruction, the program would crash, and you would have to start the whole process over again". During the late 1950s, the computer science discipline was very much in its developmental stages, and such issues were commonplace.

Time has seen significant improvements in the usability and effectiveness of computer science technology. Modern society has seen a significant shift from computers being used solely by experts or professionals to a more widespread user base.

Vocabulary development

2.4. Make up possible word combinations.

1. to predate	**a.** population
2. distinct	**b.** accepted
3. to introduce	**c.** discipline
4. exploration	**d.** field of study

5. to become
6. to be in developmental
7. to see
8. scientific
9. significant(2)
10. academic(2)

e. shift
f. period
g. punch card machines
h. areas of study
i. stages
j. improvements
k. accepted
l. the invention of smth

2.5. Find the synonyms to the following words in the text

1. count
2. restrict
3. problem
4. ancestor
5. develop
6. conventional
7. research
8. use(n)
9. subject(n)
10. precede

2.6. Match the words in A to the definitions in B

A	B
1. application	**a.** someone who has a special skill or special knowledge of a subject, gained as a result of training or experience
2. abacus	**b.** when you use numbers in order to find out an amount, price, or value
3. invention	**c.** a frame with small balls that can be slid along on thick wires, used for counting and calculating
4. technology	**d.** practical purpose for which a machine, idea etc can be used, or a situation when this is used
5. computer science	**e.** new machines, equipment, and ways of doing things that are based on modern knowledge about science and computers

6. calculation

f. a useful study of computers, their design, and their uses for computation, data processing, and systems control, including design and development of computer hardware and software, and programming.
machine, tool, instrument etc that has been invented

7. expert

2.7. Use the words from 1.6 to complete the sentences:

1. Fortran is still used today for programming scientific and mathematical **…….. .**
2. The …… of Fortran began a $24 million dollar computer software industry and began the development of other high level programming languages.
3. Back in the DOS days I was …… on linking Fortran to Assembly language.
4. Once all the necessary …… have been made the experiment can proceed.
5. In **……** one learns how to write programs that can perform certain tasks
6. Having a solid education and specific specialty certifications is the best way to progress in an …… career.
7. Make an …….. and write a report about its usefulness in terms of place value and computation

Grammar revision

2.8. Complete the following sentences with the correct form of the words in italics

1. invent, inventor, invention

a. William Seward Burroughs **……..** the first practical adding and listing machine.
b. Nevertheless, the layout of the computer keyboard still owes its origin to the **..……**of the first typewriter, Christopher Latham Sholes who also invented the QWERTY layout.
c. We are more ready to try the untried when what we do is inconsequential. Hence the fact that many …….. had their birth as toys. (Eric Hoffer)

2. improve, improvement

a. At sixteen Blaise Pascal wrote an essay on conic sections; and in 1641, at the age of eighteen, he constructed the first arithmetical machine, an instrument which, eight years later, he further **…… .**

b. Some other early computer makers found it easy to design **……** that created a better machine.

c. Soon the functionality of calculators……. beyond simple arithmetic operations.

3. develop, developer, development

a. The very first graphical user interface was **……** by the Xerox Corporation at their Palo Alto Research Center (PARC) in the 1970s.

b. With the 1984 Apple Macintosh Steve Jobs made sure **.....** created software for the new Macintosh Computer.

c. A few key technological **……** created the transition of the typewriter into the computer keyboard.

4. calculate, calculator, calculation

a. One of the most difficult aspects of doing a large **……..** with either a slide rule or a mechanical adding machine is keeping track of all intermediate results.

b. Burroughs' company mostly made **……** for banking systems, but when the company was renamed the Burroughs Corporation in 1953 it began moving into computers.

c. Using heron's formula we **……..** the area of the triangle.

2.9. Translate the sentences paying attention to the use of the Infinitive.

1. It was also clear to him that the machines should work in the binary number system, because he wanted to construct his computers using binary switching elements.

2. It was also very expensive to reconstruct all the pieces of the machine.

3. Although a powerful language, it was felt to be too complex in its syntax, and inadequate for all of Java's requirements.

4. You can use any text editor to create and edit source files.

5. Applesoft was easy to use because it was interactive. The disadvantage was a lack of more powerful commands, and it could be difficult to create large and complex programs.

6. To make portability between various different computers possible, UCSD Pascal programs were compiled into a specialized code called "P-code".

7. This makes it possible to pass complex object hierarchies to a C coder who thinks computer science has made no worthwhile advancements since the invention of the pointer.(Gordon McMillan)

8. Many inventions would have to be reviewed by engineers to make sure they are safe.

9. C ++ makes it easy to shoot yourself in the foot. C++ makes it harder, but when you do, you blow away your whole leg! (Bjarne Stroustrup)

2.10. Translate the following sentences into English:

1. Счёты существовали со времён античности.

2. Вильгельм Шикард создал первый механический калькулятор.

3. Вычислительная техника стала учебной дисциплиной в 50-ых годах 20 столетия.

4. В начале 20-го века была изобретена счётно-перфорационная машина.

5. Если вы ошибались в одной букве, то программа давала сбой.

6. В начале 50-ых годов вычислительная техника была на начальной стадии развития.

7. С течением времени компьютеры значительно усовершенствовались.

Comprehension

2.11. Mark each statement as T (True), F (False) or N (Not Mentioned).

1. Machines for calculating fixed numerical tasks, such as the abacus, have existed since antiquity.
2. Wilhelm Schickard built the first mechanical calculator in 1180.
3. Charles Babbage designed a difference engine in Victorian times helped by Ada Lovelace.
4. The IBM 024 Card Punch and IBM 026 Printing Card Punch were announced in 1949.
5. During the 1940s, as newer and more powerful computing machines were developed.
6. The field of computer science did not broaden to study computation in general.
7. Computer science became a distinct academic discipline in the 1970s and early 1980s.

8. IBM released the IBM 704 and later the IBM 709 computers, which were widely used during the exploration period of such devices.
9. Unsatisfied with the reliability of the binary switching metal sheets used in the Z1, Konrad Zuse next constructed the Z2 computer.
10. Modern society has seen a significant shift from computers being used solely by experts or professionals to a more widespread user base.

2.12. Answer the following questions

1. What machines for calculating have been known since antiquity?
2. Who was the first to have built the mechanical calculator?
3. When were punch-card machines introduced?
4. Where was the first computer science programme formed?
5. Could computers perform many tasks?
6. When did computer science become a distinct academic discipline?
7. What companies participated in computer revolution?

Speaking

2.13. Make a report on history of computer science

Unit 3

Before you read

3.1. Work in pairs or small groups. What do you know about the complex protection of information objects ?

3.2. Read the text, compare your ideas with the information given, and write some questions as a plan to summarise this text.

COMPLEX PROTECTION OF INFORMATION OBJECTS

Computers, computer networks of information systems, telecommunications are information objects. These objects need the complex protection.

Complex protection includes all methods of information protection, organizational, legal and technical protection, including program and hardware methods.

The specialists of complex protection need to know well information technologies. Therefore students learn programming, computer hardware, administration of computer networks and information systems.

Information systems include big operation systems, for example, Windows, Linux and UNIX.

Software and hardware methods are used to support the confidentiality and authenticity of the data in computer networks, databases, the telecommunication and mobile systems. These systems are based on the cryptographic algorithms.

The students also study architecture of the basic families of microcontrollers, programming languages and means of programs debugging.

The questions of creation and application protection systems occupy a special place in the training of students. The intellectual protection systems use algorithms of person biometric identification, based on finger prints, human voice and on the graphic image.

Specialists of complex protection can deal with such issues as:

1) Experimental – research activity:

a) The investigation of physical influence on the information processes in the protected objects.

b) The study of canals of informational leakage.

c) Carrying out contrastive information analyses received after researches and tests.

2) Operational activity

The graduates work as engineers in various spheres, for example, in security firms.

Vocabulary

1. legal	правовой
2. micro nuclear	микроядерный
3. confidentiality	конфиденциальность
4. authenticity	подлинность
5. database	база данных
6. debugging	отладка
7. application program	приложение, прикладная программа
8. occupy	занимать место
9. microcontrollers	микроконтроллеры
10. probability	вероятность
11. news leak	утечка информации
12. contrastive	сопоставительный

Vocabulary development

3.3. Match the words below to make word partners.

1. operation	a. networks
2. computer	b. algorithms
3. students	c. prints
4. complex	d. system
5. biometric	e. languages
6. programming	f. activity
7. research	g. protection
8. finger	h. training

Comprehension

3.4. Are the following statements true or false?

1) Information systems are information objects.

2) Specialists of complex protection need to know well history, philosophy and principles of psychology.

3) Software and hardware methods can't support the confidentiality and authenticity of the data.

4) The graduates of the faculty in this specialty work in various fields.

5) The specialists of complex protection can't carry out contrastive information analysis, because it's not their sphere of activity.

3.5. Answer the questions on the text.

1) What methods does complex protection include?

2) Why do the specialists need to know well information technologies?

3) What main operation systems do you know?

4) How do the intellectual protection systems use algorithms of personal biometric identification?

5) Where can the graduates work?

Grammar revision

3.6. Open the brackets using an appropriate form of the verb.

1) The specialists of complex protection (to solve) different problems at the moment.

2) The specialists (to discuss) the canals of informational leakage at the meeting yesterday.

3) Information objects (to need) the complex protection.

4) The students (to study) programming language for two years.

5) Intellectual systems (to use) databases.

3.7. Translate into English

1. Факультет готовит квалифицированных специалистов, и каждый студент может легко выбрать область своей специализации.

2. Студенты учатся профессионально использовать и обслуживать современное оборудование, чтобы эффективно применять его в своей исследовательской и практической деятельности.

3. Студентам АВТФ предоставляется возможность получить самые современные знания в выбранной области.

4. Выпускники, имеющие степень магистра или диплом инженера, могут поступить в аспирантуру и получить ученую степень кандидата наук.

5. Студенты, специализирующиеся в области защиты информации, обучаются 5 лет, и после окончания университета смогут работать в сфере информационной безопасности.

6. В соответствии с многоуровневой системой образования, введенной на факультете, студентам, успешно окончившим курс обучения, присуждается степень бакалавра, магистра или диплом инженера.

3.8. Open the brackets using the active or passive tense forms.

1) Computers, computer networks information systems, telecommunications (to call) information objects.

2) Algorithms of person biometric identification (to use) in the intellectual protection systems.

3) The specialists of complex protection carry out contrastive information analysis which (to receive) after researches and tests.

4) Software and hardware methods (to use) to support the confidentiality and authenticity of the data in computer networks, databases and the telecommunication and mobile systems.

5) The specialists of complex protection (to need) to know information technologies.

Speaking

3.9. Summarise the main ideas of the text.

Unit 4

Before you read

4.1. Discuss these questions with your partner.

1. What is biomedical engineering?
2. Where can students work after graduating from this departament?
3. What science is connected with biomedical engineering?

4.2. Read the text and then make a list of terms which are new for you.

WHAT IS BIOMEDICAL ENGINEERING?

Biomedical engineering (BME) is the application of engineering principles and techniques to the medical field. It combines the design and problem solving skills of engineering with medical and biological sciences to improve healthcare diagnosis and treatment.

Biomedical engineering is the study of medical equipment used in an environment of care or physiological training and how this equipment interfaces or physically interacts with the human body.

Biomedical engineering has only recently emerged as its own discipline, compared to many other engineering fields; this evolution is common as a new field transitions from being an interdisciplinary specialization among already-established fields, to being considered as a field in itself.

Much of the work in biomedical engineering consists of research and development, spanning a broad array of subfields. Prominent biomedical engineering applications include the development of biocompatible prosthesis, various diagnostic and therapeutic medical devices ranging from clinical equipment to micro-implants, common imaging equipment such as MRIs and EEGs, biotechnologies such as regenerative tissue growth, and pharmaceutical drugs and biopharmaceuticals.

Biomedical engineers design, test, modify, recommend modification of, and evaluate all medical equipment used to interface or interact with the human body. In addition to these functions, clinical engineers usually

supervise the biomedical equipment maintenance function within an environment of care.

Some biomedical engineers do not work with medical devices. These biomedical engineers use their knowledge of math to look at living systems. Living things are very complicated and biomedical engineers often make mathematical models. Using maths can help understand the living organisms better.

Biomedical engineering is a highly interdisciplinary field, influenced by various other engineering and medical fields.

Disciplines within BME can include:

- Chemical engineering – often associated with biochemical, cellular, molecular and tissue engineering, biomaterials and biotransport.
- Electrical engineering – often associated with bioelectrical and neural engineering, bioinstrumentation, biomedical imaging, and medical devices. This also tends to encompass optics and optical engineering – biomedical optics, imaging and related medical devices.
- Mechanical engineering – often associated with biomechanics, biotransport, medical devices, and modeling of biological systems.

Vocabulary development

Match the words and phrases with their definitions.

1. biomedical engineering	a. electroencephalogram
2. medical field	b. an artificial leg, tooth, or other part of the body
3. equipment	c. the items needed for a particular purpose
4. interdisciplinary	d. particularly noticeable
5. subfields	e. medical engineering
6. prominent	f. activity related to the nervous system
7. micro-implants	g. the application of engineering principles to the fields of biology and medicine
8. MRI	h. act so as to have a reciprocal effect
9. EEG	i. artificial tiny details of organism
10. tissue	j. part
11. to interact	k. the process of debugging or being maintained

12. maintenance	l. relating to more than one branch of knowledge
13. living systems	m. systems necessary to stabilize the patient life
14. prostheses	The material from which animals or plants are made
15. neural	Magnetic Resonance Imaging

Comprehension

4.4. Now read the text again and decide whether these statements are true or false.

1. Biomedical engineering is the science about people's health.
2. All biomedical engineers work with medical devices.
3. Chemical engineering is the heart of Biomedical engineering.
4. Prominent biomedical engineering applications include the development of biocompatible processes.
5. Sometimes biomedical engineers make models of living systems.
6. Biomedical engineers use their knowledge of math to look at living systems

4.5. Answer the questions.

1. What have you learnt from the text about biomedical engineering?
2. What special knowledge is necessary for the biomedical engineer?
3. What is biomedical engineering concerned with?
4. What is the difference between "Biomedical engineering" and "Mechanical Engineering"?

Grammar revision

4.6. Put the verbs in the correct tense–aspect forms

1. Biomedical engineering (to have) only recently emerged as its own discipline.
2. Living things (to be) very complicated, so biomedical engineers often (to make) models so the math is easier.
3. Prominent biomedical engineering applications (to include) the development of biocompatible prosthesis.
4. Biomedical engineers (to design) and (to evaluate) all medical equipment used to interface or interact with the human body.
5. Some biomedical engineers (not to work) with medical devices.

4.7. Transform these passive sentences into active ones.

1. Sometimes, disciplines within BME are classified by their associations with other, more established engineering fields

2. Chemical engineering is often associated with biochemical, cellular, molecular and tissue engineering, biomaterials, and bio transport.

3. Electrical engineering is associated with bioelectrical and neural engineering, bioinstrumentation, biomedical imaging, and medical devices.

4. Mechanical engineering is often associated with biomechanics, bio transport, medical devices, and modeling of biological systems.

4.8. Fill in the gaps with appropriate words from the box.

Biomedical 1. _____ apply engineering principles and materials technology to healthcare. This can 2. _____ researching, designing and developing medical products, such as joint replacements or robotic surgical instruments; designing or modifying 3. _____ for clients with special needs in a rehabilitation setting; or managing the use of clinical equipment in 4. _____ and the community.

Biomedical engineers can be employed by 5. _____ services, medical equipment 6. _____ and research departments.

Job titles can vary 7. _____ on the exact nature of the work. As well as biomedical engineer you are likely to come across 8. _____; design engineer; and 9. _____ scientist.

hospitals	bioengineer	engineers	manufacturers	equipment
include	health	depending	clinical	

Speaking

4.9. Imagine that you are a biomedical engineer. What can you offer to this branch of engineering? What problem will it solve? Explain your choice.

(For example: to offer a new type of implant or clinical equipment.)

JARVIK-7 is an artificial heart, an example of a biomedical engineering application of mechanical engineering with biocompatible materials for cardiothoracic surgery using an artificial organ.

4.10. Discuss the main ideas of the text in class.

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MODULE IV

Faculty of Mechanics and Technology

Unit 1

Before you read

1.1. Discuss the following questions with your partner

Why have you entered the faculty of Mechanics and Technology?
What do you know about the faculty?
What do you want to know about the faculty?

1.2. Read the text and match the headings A –E with the paragraphs 1 – 4. There is one extra heading which you don't need to use.

A. Career opportunities
B. Course structure
C. Students' training
D. History of the faculty
E. Faculty departments

THE FACULTY OF MECHANICS AND TECHNOLOGY

1. The faculty of Machine Building was established at Novosibirsk Institute of Electrical Engineering in 1956 due to the great demand for mechanical engineers in Siberian Region. In 1959 The Aircraft Construction Faculty was set up on its basis and in 1979 The Instrument –Making Faculty was branched off. Up to 1964 the faculty trained engineers in the field of manufacturing engineering and metal-cutting machines tools. In 1965 a new course in electrophysical machining methods was opened. In 1998 the faculty was renamed due to opening new degrees and introducing multilevel system of training. Now it is known as the Faculty of Mechanics and Technology.

2. At present the faculty incorporates 10 departments. It awards Bachelor's and Master's degrees in the field of automatic machine building production; materials science and new materials technology and Engineer's degree in the field of manufacturing engineering; metal cutting machine

tools and tooling; automation of manufacturing processes and production; material science in machine building; machine and apparatus for food industry; technology of decorative material working. Besides some departments provide training in additional areas thus extending the major field. Also the faculty provides training of Candidates and Doctors of Science. There is a special D.Sc. Council in the area of "Processes of mechanical and physical and technical treatment, machine tools and tooling".

3. The Faculty has well-equipped workshops and research laboratories specializing in laser, ultrasonic treatment, spark erosion electrochemical machining and computer classes equipped with up-to-date computers having an access to the Internet. The academic staff includes about 100 highly qualified teachers, among them 18 D.Sc. and professors and 58 Cand.Sc. and associate professors. Students receive fundamental knowledge in basic subjects and professional training in a wide range of major disciplines such as computer technology, economics, management and industrial engineering. Students undergo industrial training in the leading enterprises of Novosibirsk.

4. The faculty graduates work as designers, process engineers, foremen, adjusters and research engineers at large-scale and small-scale enterprises, design offices and research institutes of Siberian Branch of Russian Academy of Science. Many of them have been promoted to the position of directors and chief engineers of plants and design institutes. Broad education in mechanical engineering, economics and computer-aided design allow the graduates to specialize in the chosen field of professional activity and to get adapted to the conditions of work at commercial enterprises.

Vocabulary

1. faculty of mechanics and technology	механико-технологический факультет
2. machine building/ machine engineering	машиностроение
3. mechanical engineer	инженер-механик
4. instrument making/ instrument engineering	приборостроение
5. manufacturing engineering	технология машиностроения
6. metal-cutting tool	металлорежущий станок
7. electrophysical machining methods	электрофизические методы обработки
8. manufacturing/ production methods and apparatus	технологические процессы и аппараты
9. (mechanical) drawing	черчение
10. engineering/ technical drawing	инженерная графика

11. applied mechanics	прикладная механика
12. theoretical mechanics	теоретическая механика
13. strength of materials	сопротивление материалов
14. laser treatment	лазерная обработка
15. ultrasonic treatment	ультразвуковая обработка
16. material science	материаловедение
17. tooling	инструменты
18. metal working	обработка металла
19. workshop	мастерская, цех
20. enterprise	предприятие
21. plant, factory	завод
22. design	проектирование
23. computer aided design	машинное проектирование
24. industrial training	производственная практика
25. demand for	потребность в

Vocabulary development

1.3. Match pairs of words with similar meanings from items A and B

A	B
1. demand	a. production
2. field	b. big
3. manufacturing	c. enterprise
4. building	d. need
5. large-scale	e. to get
6. working	f. to teach
7. to establish	g. modern
8. to train	h. treatment
9. to receive	i. main
10. plant	j. area
11. leading	k. to set-up
12. up-to-date	l. construction

1.4. Match the following words with their definitions

a) machine b) mechanics c) tool d) staff e) design
f) laboratory g) workshop h) plant

1. _____ is something that you hold in your hand and use to do a particular job.

2. _____ is a piece of equipment that uses power such as electricity to do a particular job.
3. _____ is the science that deals with the effect of forces on objects.
4. _____ is a special room or building where scientists test and prepare substances
5. _____ is a factory that makes cars, machines, equipment etc.
6. _____ are people who work for a particular company, organization or institute.
7. _____ is a room or a building where things are made using machines
8. _____ is the process of deciding how something will be made, how it will work and look.

1.5. Find the following key words and word combinations in paragraphs 1 –4. Each paragraph contains 5 words or word combinations.
/work as/ /was established/ /well-equipped workshops/ /incorporate/ /graduates/ /up-to-date computers/ /manufacturing process/ /demand/ /broad education/ /receive training/ /machine tools/ /was set up/ /large-scale enterprises/ /staff/ /technical treatment/ /was branched off/ /specialize in/ /undergo industrial training/ /material science/ /was renamed/

Grammar revision

1.6. Choose the correct verb in brackets and answer the following questions

1. When (did/ does/ was) the faculty established?
2. Why (were/ was/ did) the faculty renamed in 1998?
3. How many faculties (---/ does/ is) the faculty incorporate?
4. What degrees (does/ ---/ is} the faculty award?
5. What teaching facilities (is / do / does) the faculty provide the students with?
6. Where (are/ do / ---) students undergo industrial training?
7. What (---/ does / is) allows students to find a good job?

Speaking

1.7. Speak on the topic The Faculty of Mechanics and Technology using exercises 1.2 and 1.5

Unit 2

2.1. Read the text and state whether the following sentences are true(T)or false(F)

1. Mechanical engineering is concerned with building houses, palaces, pyramids and other structures (T/F)
2. Mechanical engineering branched off civil engineering with the invention of the steam engine. (T/F)
3. Mechanical engineering is closely connected with all branches of engineering using electricity. (T/F)
4. Steam turbine is the example of prime mover. (T/F)
5. The creation of "unmanned" industries will increase the service life of machines. (T/F)
6. Strengthening treatment will allow to increase productivity several times. (T/F)
7. The term "engineering" was known many thousands years ago. (T/F)

THE HISTORY OF MECHANICAL ENGINEERING

Engineering is a science which deals with design, construction and operation of structures, machines, engines and other devices used in industry and everyday life. The term "engineering" is a modern one. However the art of building houses, palaces, pyramids and other structures was known as far back as many thousands years ago. Now we call it "civil engineering". As time went on the art of civil engineering was enriched with new achievements of science and technology. With the invention of the steam engine and the growth of factories a number of civil engineers became interested in the practical application of the science of mechanics and thermodynamics to the design of machines. Mechanical engineering has been recognized as a separate branch of engineering since the formation of the Institution of Mechanical Engineers of Great Britain in 1847.

The development of the textile machinery, turbines, machine tools, pumping machinery and locomotives of that time made such a diversity interest. Mechanical engineering deals with machines and devices of all kinds and with research and science upon which they depend. Among these machines are prime movers such as engines and turbines using air, gas, steam and water as operating media; pumping machines and other hydraulic apparatus; steam boilers, heating, ventilating, air conditioning and refrigerating

equipment, transportation structures used in aviation; automotive engineering, railroads and ships, machine tools, special machines for industry and for construction of buildings, railroads and harbors. In fact, mechanical engineers enter into the work of all engineers in other branches of engineering.

The scientific and technological progress will continue in engineering along two main headlines. Firstly, it is automation, including the creation of "unmanned" industries. Secondly, raising the reliability and extending the service life of machines. This certainly requires new technology. Intense work is being carried out on new robots which can identify objects, their position in space, etc. A promising reserve in increasing the life of parts is strengthening treatment. In recent years new highly efficient methods have been found. In the shortest time possible the engineers are to start producing new generations of machines and equipment which would allow manufactures to increase productivity several times and to find a way for the application of advanced technologies. First is the vacuum plasma methods for coating components with hard alloy compounds, such as nitrides and carbides of titanium, tungsten and boron.

Vocabulary development

2.2. Match the English words to their Russian equivalents.

1	steam engine	a	насос
2	prime mover	b	срок годности
3	pumping machine	c	паровой двигатель
4	reliability	d	применение
5	service life	e	повышение механических свойств
6	application	f	первичный двигатель, тягач
7	strengthening	g	надежность

2.3. Read the following international words and check their pronunciation in a dictionary.

thermodynamics	hydraulic
ventilating	refrigerating
transportation	automation
structure	pyramid
turbine	textile
identify	efficient

2.4. Match the following words with their definitions

turbine/ boiler/ refrigerator/ productivity/ engine/ ventilator/ hydraulic/ pump

1. _____ is a machine with moving parts that uses fuel to produce movement
2. _____ is a piece of equipment for making a liquid or gas move into or out of smth.
3. _____ is a machine that heats water and provides hot water for a heating system.
4. _____ means using of water or oil to make a machine work.
5. _____ is a machine that brings fresh air into a room or a building.
6. _____ is a machine that keeps food or drinks cold.
7. _____ is the rate at which goods are produced.
8. _____ is a machine that uses the pressure of liquid or gas on a wheel to get power.

2.5. Complete the following sentences and translate them

1. Engineering deals with …
2. With the invention of the steam engine and the growth of factories …
3. Mechanical engineering has been recognized as a separate branch of engineering since …
4. Mechanical engineering is concerned with …
5. The scientific and technological progress will go on …
6. Raising reliability requires …
7. New generations of machines and equipment would allow …

Speaking

2.6. Speak on the topic Mechanical Engineering and Machine Building. (200 – 250 words). Make use of the following plan.

1. The History.
2. Spheres of useage.
3. Further development.

Unit 3

3.1. Read the text and answer the questions:

1) What are metals and what do we call metallurgy?
2) Why are most metals dense?
3) Why are metals malleable?

4) What are grains?
5) What is alloying?
6) What is crystalline structure?
7) What changes the size of grains in metals?

METALS

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

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

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

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

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

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

Vocabulary:

1. arrangement – расположение
2. coarse – грубый, крупный
3. to draw – тянуть

4. lead – свинец
5. to hammer – ковать
6. rolling – прокатка
7. metal fatigue – усталость металла
8. vessel – сосуд, котел
9. to cast – отливать
10. stress – давление, напряжение
11. separation – интервал, расстояние
12. dense – плотный
13. treatment – обработка
14. ductile – эластичный, ковкий

Comprehension

3.2. Complete the following sentences

1. Metals are …
2. Metallurgy is …
3. Most metals are …
4. The regular arrangement of atoms in metals …
5. The properties of the metals depend on …
6. Metals with small grains will be …
7. … controls the nature of the grains in the metal.
8. Alloying is …

3.3 Translate into English

1. Металлы имеют кристаллическую структуру из-за правильного расположения атомов.

2. Чем меньше зерен, тем тверже металл.

3. Легирование изменяет структуру зерен и свойства металлов.

4. Металл деформируется и разрушается из-за усталости и ползучести.

5. Металлы – плотные материалы потому, что между атомами в металлах малое расстояние.

Unit 4

4.1. Read the text and find the English equivalents to the following Russian word-groups.

1) могут легко деформироваться
2) нужные формы
3) температура перекристаллизации
4) пластическая деформация сжатия

5) самое обычное изделие проката
6) зазор между плунжером и штампом
7) протягивание металла через фильеру
8) волочение проволоки
9) уменьшение диаметра
10) растягивать выше точки текучести

METALWORKING

Metals are important in industry because they can be easily deformed into useful shapes. A lot of metalworking processes have been developed for certain applications. They can be divided into five broad groups: rolling, extrusion, drawing, forging, sheet-metal forming.

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

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

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

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

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

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

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

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

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

Vocabular:

1. rolling – прокатка
2. extrusion – экструзия, выдавливание
3. drawing – волочение
4. forging – ковка
5. sheet – лист
6. cross section – поперечное сечение
7. die – штамп, фильера
8. to subject to – подвергать
9. initial – первоначальный
10. to harden – упрочнять

Comprehension

4.2. Answer the questions

1) Why are metals so important in industry?
2) What are the main metalworking processes?
3) Why are metals worked mostly hot?
4) What properties does cold working give to metals?
5) How can the reduction of diameter in wire drawing be achieved?
6) What is sheet metal forming and where it can be used?

4.3. Match the following prefixes from the box with their definitions:

inter-	post-	bi-	pre-	multi-	ex-

a) more than one; many
b) later than;after
c) before; in preparation

d) former and still living
e) between; among a group
f) two; twice; double

4.4.Translate into English

1) Перекристаллизация- это рост новых, свободных от деформации зерен.

2) Во время горячей обработки металл может подвергаться очень большой пластической деформации сжатия.

3) Поверхность холоднокатанного листа более гладкая, и он прочнее.

4) Поперечное сечение фильеры для экструзии может быть простым или сложным.

5) При волочении проволоки диаметр отверстия волочильной доски каждый раз уменьшается.

6) Штамповка листового металла включает в себя ковку, изгиб и обрезку.

7)Небольшая деформация листа при растяжении помогает сохранить новую форму детали.

8) При проковке деталь должна быть горячей для уменьшения необходимых усилий и увеличения пластичности металла.

Unit 5

5.1. Read the following web page and complete the missing headings using the words :

a. Aluminium b. Copper c. Glass d. Plastic e. Rubber
f. Steel g. Timber.

RECYCLABLE MATERIALS

1) … Scrap can be sorted easily using magnetism. If the metal is galvanized (coated with zinc) the zinc is fully recyclable. If it is stainless steel, other metals mixed with the iron, such as chromium and nickel, can also be recovered and recycled.

2) … Sorting is critical, as there are key differences between the clear and coloured material used in bottles and jars, and the high-grade material used in engineering applications, which contains traces of metals.

3) … Scarcity makes recycling especially desirable, and justifies the cost of removing insulation from electric wires, which are a major source of scrap. Pure metal can also be recovered from alloys derived from it, notably brass (which also contains quantities of zinc, and often lead) and bronze (which contains tin).

4) … The cost of melting down existing metal is significantly cheaper than the energy-intensive process of electrolysis, which is required to extract new metal from ore.

5) … Hardwood and softwood can be reused. However, the frequent need to remove ironmongery and saw or plane off damaged edges, can make the process costly.

6) … Tyres are the primary source of recyclable material. These can be reused whole in certain applications. They can also be ground into crumbs which have varied uses.

7) … An obstacle to recycling is the need to sort waste carefully. While some types can be melted down for reuse, many cannot, or result in low-grade material.

5.2. Match the materials (1-8) to the definitions (a-h).

1. stainless steel	a. a metal used to make brass, and in galvanized coatings on steel
2. zinc	b. the predominant metal in steel
3. iron	c. a type of steel not needing a protective coating, as it doesn't rust
4. bronze	d. a dense, poisonous metal
5. lead	e. rocks from which metals can be extracted
6. hardwood	f. an alloy made from copper and tin
7. ore	g. timber from pine trees
8. softwood	h. timber from deciduous trees

5.3. Complete the following sentences using *from, with* or *of*.

1. Bronze contains significant amounts … copper.
2. Galvanised steel is steel coated … zink.
3. Steel is an alloy derived … iron.
4. Pure metals can usually be recovered … alloys.
5. To produce stainless steel, iron is mixed … other metals.
6. Stainless steel contains quantities … chromium and nickel.
7. Glass tableware contains traces … metals, such as lead.
8. When new metal is extracted … ore, the costs can be high.

Compiled by Atabaeva L. Sh. (Units 2, 3),
Nee A. A. (Units 1, 4, 5)

MODULE V

Faculty of Mechatronics and Automatization

Unit I

Before you read

1.1. Answer the following questions:

1. When was the faculty of Mechatronics and Automatization organized?
2. What is the previous name of the faculty?
3. What programmes does the faculty offer its students?
4. Does the faculty award degrees? What are they?
5. What can you say about the facilities the faculty provides the students with?

1.2. a) Read the text and compare your answers with the information given in the text.
b) Write some questions as a plan to summarize this text.

THE FACULTY OF MECHATRONICS AND AUTOMATIZATION

Organized in 1953, Electromechanical Faculty is the oldest at Novosibirsk State Technical University (NSTU). The Faculty was renamed as the Faculty of Mechatronics and Automatization in 2009. 15000 engineers for various segments of the national economy such as electrical and power industries, metallurgy, aerospace and transport industries, and others have been trained since that time. Electromechanics is an interdisciplinary subject, and the practical applications of the principles which it embodies could well contribute to massive savings of money in industry. And the programmes offered by the Faculty are aimed at encouraging students to develop interdisciplinary processes, knowledge and skills.

The Faculty offers a multi-level specialist education scheme which provides a large variety of programmes at Bachelour of Science, Master of

Science and Engineer of Science levels. The Faculty awards the Bachelor's (B.Sc.) degree after successful completion of a four-year programme of study. After obtaining the B.Sc. degree students may undertake a two-year programme leading toward the Master's (M.Sc.) degree with emphasis on theoretical and applied research. It is the policy of the Faculty that research should be carried out in topics which are likely to be industrially or socially useful. Another opportunity for professional career-oriented students is a five-year programme of study leading to the award of the Diploma in Engineering. In addition, the Faculty offers an accelerated two-year programme leading to the award of the Diploma in Engineering to students having associate degrees earned at technical or vocational secondary schools. Graduates holding the M.Sc. degree or Diploma in Engineering wishing to follow a scientific career may prefer to take a postgraduate, Candidate of Sciences programme, in the area of specialization. Career prospects for graduates are exceptionally good. On leaving the Faculty students seeking employment are offered jobs at large industrial plants, companies and firms.

Competent and experienced academic and research staff teach at the Faculty. Many staff members have highest degrees. Some faculty members have won international grants in support of their research. Members of the teaching staff also serve as academic advisers and help students plan their undergraduate and graduate programmes.

Teaching and research facilities include a wide array of instructional laboratories in the University, computer classes equipped with personal computers having an access to the Internet and the richest in the city library.

Training is offered on a full-time or part-time basis. Tuition at the Faculty is free only for those students who fully meet the admissions requirements and successfully pass entrance examinations. Otherwise tuition is sponsored by students themselves, their parents and other private individuals or industrial organizations on a contract basis.

1.3. Read and learn the vocabulary.

1. various, adj.	различный, разный
2. variety, n.	множество, ряд, разнообразие
3. embody, v.	воплощать
4. contribute to smth., v.	делать вклад
5. associate degree	диплом техника
6. interdisciplinary processes	междисциплинарные процессы
7. obtain, v.	получать
8. encourage, v.	поощрять, стимулировать

9. undertake a course	проходить курс
10. career-oriented students	студенты, ориентированные на карьерный рост
11. emphasis, n.	акцент
12. carry out a research	проводить исследование
13 accelerated programme	ускоренная программа
14. vocational school	профессионально-техническое училище
15. seek, v.	искать
16. array,n.	ряд
17. otherwise, adv.	иначе, по-другому

Comprehension

1.4. Decide if the statements are *true*(T) or *false*(F).

1. The faculty started to work in 1963.
2. Electromechanics is the major subject taught at the faculty.
3. The faculty offers various programmes at associate, baccalaureate, postbaccalaureate and professional diploma levels.
4. Students of the faculty are awarded a Bachelor's degree after four years of study.
5. After five years of study students are awarded a Master of Science degree.
6. Training is offered only on a full-time basis.
7. Students have to pay for their education.
8. Graduates may prefer to take an accelerated two-year programme leading to the award of Candidate of Science degree.
9. Career prospects for graduates are good, they are offered jobs at plants and companies.

Vocabulary development

1.5. Match the words on the left with the definitions on the right.

1. seek	a. a lot of things of the same type that are different from each other in some way
2. research	b. smth. that happens faster than usual, sooner than you expect
3. contribute	c. professional
4. variety	d. look for
5. carry out	e. make yourself responsible for smth. and start doing.
6. vocational	f. chances of success

7. accelerated	g. qualification given by university
8. undertake	h. serious study of a subject in order to discover new facts or test new ideas.
9. prospects	i. give money, time, help.
10. degree	j. conduct, do

1.6. Match the words in order to get the pairs of antonyms.

1. various	a. find
2. seek	b. part-time
3. contribute	c. give
4. obtain	d. similar
5. full-time	e. take back

1.7. Match the words in order to get the pairs of synonyms.

1. carry out	a. different
2. vocational	b. qualification
3. various	c. array
4. degree	d. conduct
5. variety	e. professional

1.8. Fill in the gaps using the words from the box.

emphasis	prospects	accelerated	carrying out
undertake	contribute	array	requirement

1. The graduates of this faculty have good career _____ .
2. The students have an opportunity of _____ their researches in well-equipped laboratories.
3. You should _____ this course in order to get the Master's degree.
4. Last year we were offered the course with _____ on practical activity.
5. Students of technical and vocational secondary schools may undertake _____ programme to get the Diploma in Engineering.
6. If students fully meet the admission _____and successfully pass entrance examinations they will study free of charge.
7. All the faculties of our university provide the students with a great _____ of programmes.
8. Students doing research are sure to _____ significantly to the development of their faculties.

1.9. Complete the sentences by giving English equivalents to the Russian words.

1. The faculty *присуждает* Bachelor's degree after 4 years of study.
2. Graduates of the faculty have great *перспективы* in future career.
3. Academic *коллектив* of the faculty helps students with their research and projects.
4. Students are provided with teaching and research *средствами* such as laboratories and computer classes.
5. The faculty offers training on a *очной* and part-time basis.

1.10. Scan the text and say what these numbers refer to.

5 1953 2 2009 15000 4

Grammar revision

1.11. Fill the gaps with the verbs from the box. Put them in –ing form or Infinitive form.

carry out		offer
seek	teach	award

1. The students were interested in _____ the experiment.
2. He phoned a lot of plants and enterprises in _____ employment.
3. The council appeared _____ degrees to students.
4. The professor said he planned _____ his help in conducting the experiment.
5. She got a job _____ English at a local university.

1.12. Complete the sentences using 3 types of conditional sentences.

1. If I were the Dean of this Faculty …
2. If he had studied on a part-time basis …
3. If she passes entrance examinations …

Speaking

1.13. Fill the table using the information from the text.

Historical facts(foundation, name)	
Degrees	
Career prospects	
Academic staff	
Teaching facilities	
Tuition fee	

1.14. Make a presentation using the notes from 1.13.

Unit 2

Before you read

2.1. Discuss the questions in groups:

– **What do you know about history of electric vehicles?**

– **What famous carmakers do you know?**

2.2. Read the text and discuss in pairs the formation of electric power industry and its step by step development. Pay attention to the words highlighted:

HISTORY OF ELECTRIC MOTOR VEHICLE

Electric motive power started with a small railway operated by a **miniature** electric motor, built by Thomas Davenport in 1835. In 1838, a Scotsman named Robert Davidson built an **electric locomotive** that **attained** a speed of four miles per hour (6km/h). In England a **patent** was granted in 1840 for the use of rails as **conductors of electric current** and similar American patent was **issued** to Lilley and Cohen in 1847.

Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland **invented** the first **crude electric carriage** powered by **non-rechargeable primary cells**.

By the 20th century, electric cars and rail transport were **commonplace**, with **commercial** electric automobiles having the majority of the market. Over time their general- purpose commercial use **reduced** to special roles as **platform trucks**, **forklift trucks** and **urban delivery vehicles**, such as the **iconic British milk float**; for most of the 20th century, the UK was the world's largest user of electric road vehicles.

Electrified trains were used for coal transport as the motors did not use precious oxygen in the mines. Switzerland's **lack** of natural fossil resources forced the rapid electrification of their **rail network**. One of the earliest rechargeable batteries – the Nickel-iron battery – was favored by Edison for use of electric cars.

Electric vehicles were among the earliest automobiles, and before the **preeminence** of light, powerful internal combustion engines, electric automobiles held many vehicle land speed and distance record in the early 1900s. They were produced by Baker Electric, Columbia Electric, Detroit Electric, and others and at one point in history **out-sold gasoline-powered vehicles.**

Nowadays, electric vehicles are **hitting** the **mainstream.**

All major carmakers, such as Daimler AG, Toyota Motor Corp, General Motors Corp, Renault SA, Peugeot-Citroen VW and Mitsubishi Corp., are developing new-generation electric vehicles.

2.3. Study the vocabulary of the text below.

1. electric motive power	средства передвижения работающие на электричестве
2. miniature electric motor	электродвигатель
3. electric locomotive	электровоз
4. conductor of electric current	проводник электрического тока
5. to issue/to grant a patent	выдавать патент
6. to invent	изобретать, создавать
7. crude electric carriage	экспериментальная электрическая машина
8. non-rechargeable primary cells	незаряжаемые электрические ячейки, производящие ток посредством необратимой химической реакции
9. commonplace	обычное явление
10. commercial electric automobiles	серийные электромобили
11. platform truck	грузоподъёмник с платформой
12. forklift trucks	автопогрузчик, вилочный погрузчик
13.urban delivery vehicles	городское транспортное средство доставки
14. preeminence	преимущество, первенство
15. lack	отсутствие, недостаток
16. rail network	сеть железнодорожных путей
17. media campaign	кампания, проводимая СМИ
18. public acceptance	принятие (товара, идеи) общественностью
19. outsold	самые продаваемые
20. hit the mainstream	бить рекорды

Comprehension

2.4. Answer the following questions:

1. When was a miniature electric motor built? Who was the author of this invention?
2. What was built by Robert Davidson in 1838?
3. A patent for the use of rails as conductors of electric current was granted in 1840 in the USA, wasn't it?
4. Who invented the first crude electric carriage and when?
5. Why were electric cars and rail transport commonplace?
6. What was the purpose of electrified trains?
7. What vehicles were among the earliest automobiles?
8. What main manufacturers of the electric automobiles appeared in early 1900s?
9. Are electric vehicles hitting the mainstream nowadays?
10. What carmakers are developing a new generation of electric vehicles nowadays?

2.5. Decide if the statements are true (T) or false (F). Read the Text to check your answers:

1. The electric motive power started with a big space operated by a giant electric engine built by Edison in 1840.
2. In 1838 an American named Robert Davidson built a fuel locomotive that attained a speed of 10 miles per hour (12 km/hour).
3. Between 1832 and 1839 Robert Anderson of Scotland invented one of the best vehicles in the world powered by non-rechargeable Primary cells.
4. By the 20^{th} century electric cars and rail transport were a rare phenomenon in the car industry.
5. Electrified trains were used for water transport.
6. Switzerland's availability of natural fossil resources forced the rapid electrification of their rail network.
7. All major carmakers, such as Daimler AG, Toyota Motor Corp, General Motors Corp, Renault SA, Peugeot-Citroen VW and Mitsubishi Corp., are suspending developing new-generation of electric vehicles.

Vocabulary development

2.6. Match the words in order to get the pairs of synonyms:

1. to issue a patent	a. to create
2. to attain a speed	b. to grant a patent

3. to invent	c. to achieve a speed, to reach a speed
4. public acceptance	d. engine
5. media campaign	e. license, certificate
6. motor	f. to decrease
7. to reduce	g. press campaign

2.7. Match the words in order to get the pairs of antonyms:

1. miniature	a. increase
2. commercial	b. availability
3. reduce	c. single produced
4. lack	d. not ordinary phenomenon, unusual
5. commonplace	e. rechargeable
6. non-rechargeable	f. rural delivery vehicles
7.urban delivery vehicles	g. giant

2.8. Fill in the gaps:

Electric locomotive, commonplace, miniature, preeminence, crude electric carriage, commercial, platform trucks, forklift trucks, rechargeable primary cells, iconic British milk float, out-sold gasoline-powered vehicles, conductors of electric current, internal combustion engines.

1. Electric motive power started with a small railway operated by a ……. electric motor, built by Thomas Davenport in 1835.

2. In 1838, a Scotsman named Robert Davidson built an …… that attained a speed of four miles per hour (6km/h).

3. In England a patent was granted in 1840 for the use of rails as ……..**.**

4. Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland invented the first ……, powered by ……...

5. By the 20th century, electric cars and rail transport were ……., with …… electric automobiles having the majority of the market.

6. Over time their general- purpose commercial use reduced to special roles as ……, ……..and urban delivery vehicles, such as the ……;

7. Electric vehicles were among the earliest automobiles, and before ……..of light, powerful …….. electric automobiles held many vehicle land speed and distance record in the early 1900s.

8. They were produced by Baker Electric, Columbia Electric, Detroit Electric, and others and at one point in history ……

2.9. Match the words from two columns to make word combinations:

1. electric motive	a. mainstream
2. to attain	b. speed
3. to Hit	c. electrical carriage
4. crude	d. power
5. rail	e. primary cells
6. non-rechargeable	f. network

2.10. Complete the sentences:

1. Electric motive power started with a small railway operated by …….

2. In England the patent was granted…….

3. Between 1832 and 1839 (the exact year is uncertain), ……

4. By the 20th century, electric cars and rail transport were …….

5. Over time their general- purpose commercial use ……..

6. Electrified trains **……..**

7. Switzerland's lack of natural fossil resources ……..

8. Electric vehicles were among ……..

9. Nowadays, electric vehicles …….

10. All major …….

Speaking

2.11. Summarize the text.

Grammar revision

2.12. State the form and function of the Infinitive. Translate the sentences into Russian.

1. To fulfill this condition was out of my power. 2. His aim is to master English. 3. Suddenly she felt the need to speak. 4. I want to use your dictionary. 5. I went in to see if they were ready. 6. He is too young to understand

it. 7. He demanded to be heard. 8. She gave him some water to drink. 9. We met to discuss and arrange our plans. 10. It all sounds too good to be true.

2.13. Replace the following complex sentences or groups of sentences by simple sentences with the Infinitive. Translate the sentences into Russian.

Model: They sent me to the University. They wanted me to study the electronics.

They sent me to the University to study the electronics.

1. I am buying bread. I want to feed the bird.
2. Mechanical engineers design machine-tools. This is their task.
3. He rushed into burning house. He wanted to save the child.
4. She is saving up. She wants to buy a car.
5. I am glad that I have finished the calculations for the new engine at last.

2.14. Open the brackets using the appropriate form of the Infinitive. Translate into Russian.

1. The electricity is used (to propel) the vehicle in many different ways.
2. Wind, water and sun may be used (to provide) energy.
3. The young vehicle engineer hoped (to involve) in designing a new type of motor.
4. I hate to bother you, but the students are still waiting (to give) books for their work.
5. She sat there trying to pretend she did not want (to dance) and was quite pleased (to sit) there and (to watch) the fun.

2.15. Translate into English.

1. Нам понадобилось немало времени на то, чтобы убедить его, что он не прав.
2. План нашей работы будет обсуждаться на заседании, которое состоится завтра.
3. Метод, который будет использоваться в производстве деталей для нового двигателя, был разработан исследователями нашего института.
4. Вы приехали для участия в конференции?
5. Он – спокойный и сдержанный человек. С ним легко иметь дело.

Unit 3

Before you read

3.1. Answer the following questions:

1. What is an electric vehicle? What do you know about electric vehicles?
2. What types of electric vehicle do you know?
3. What parts does the electric vehicle consist of? Make the list of electric vehicle parts and compare it with a partner.

3.2. Give the examples of a new model of electric vehicle. What company produces it? Compare it with the previous original model. Which features are different? Is the new one better?

3.3. Now read the text. Make a list of the facts that are new for you. Compare your list with a partner.

ELECTRIC VEHICLES. TYPES OF ELECTRIC VEHICLES

An electric vehicle (EV) is a vehicle with one or more electric motors for **propulsion.**

This is also **referred to as an electric drive vehicle**. The **motion** may be provided either by **wheels or propellers** driven by **rotary motors**, or in the case of **tracked vehicles**, by **linear motors**.

Unlike an **internal combustion engine (ICE**) that is tuned to specifically operate with a particular fuel such as gasoline or diesel, electric drive vehicle needs electricity, which comes from sources such as batteries or a generator. This **flexibility** allows the drive train of the vehicle to remain the same, while the **fuel source** can be changed.

The electricity used **to propel** the vehicle may be provided in many different ways, the energy can come from any source, fossil fuels, **nuclear power**, solar, wind and etc. and this energy can either be **supplied** to the vehicle continuously as it is used or **stored** in the vehicle in some way, such as batteries or **fuel cells**.

Electric vehicles can include electric cars, electric trains, electric airplanes, electric boats, and electric motorcycles and scooters even **electric spacecraft**.

3.4. Study the vocabulary to understand the text below. After that:

- **count how many words/word combinations you've known before**
- **elicit words/word combinations you would like to learn**

1. electric vehicle	электромобиль
2. propulsion	продвижение вперёд, движение вперёд
3. to refer to as electric drive vehicle	относиться к таким машинам ,как например, электроприводная машина
4. motion	движение
5. flexibility	гибкость, подвижность
6. fuel cell	топливная ячейка, тепловыделяющий элемент
7. linear motor	линейный двигатель, индукторный двигатель
8. internal combustion engine (ICE)	двигатель внутреннего сгорания
9. rotary motor	поворотный двигатель
10. nuclear power	атомная энергия, ядерная энергетика,
11. drive train	цепь привода, кинематическая цепь
12. propulsion	привод, движущая сила, двигатель
13. to supply	питать, снабжать
14. store	хранить, наполнять
15. tracked vehicle	гусеничная машина
16. to tune	приспосабливаться, настраивать, наладить
17. battery	аккумулятор
18. spacecraft	космический корабль, летательный аппарат

Vocabulary development

3.5. Find equivalents to the following phrases:

Машина с одним или несколькими двигателями, также относиться к таким машинам ,как например, электроприводная машина, движение осуществляется как колёсами, так и движителями, в случае с рельсовой

тележкой, в отличие от двигателя внутреннего сгорания, приспособлен для того, чтобы специально работать на, берётся из таких источников как аккумулятор или генератор, энергия также может непрерывно «питать» машину, используется и сохраняется, в аккумуляторе или топливной ячейке

3.6. Translate the following sentences into English:

1. Электромобиль – это машина с одним или несколькими электрическими двигателями необходимые для передвижения машины.

2. Данное движение может осуществляться как с помощью колёс, так и движителя, которые приводятся в движение с помощью поворотного двигателя, а в случае с гусеничной машиной – с помощью линейного двигателя.

3. Данная гибкость позволяет цепи привода в машине оставаться той же самой, в то время как источник питания может изменяться.

4. Электричество, используемое для приведения в движение машины, может быть представлено разными способами.

5. Энергия может исходить из любого источника – ископаемого топлива, ядерной энергии, солнечной энергии, ветра и т.д.

6. Электромобили могут включать электрические машины, электропоезда (электрички), электрические самолёты, электрические лодки, электрические мотоциклы и мотороллеры и даже электрические космические корабли.

Comprehension

3.7. Answer the following questions:

1. What is an electric vehicle?
2. Does the electric drive vehicle need diesel or electricity? Why?
3. Where does the electricity come from?
4. What types of fuels do you know?
5. Why does an electric vehicle need the electricity?
6. Where does the energy come from?

3.8. Match the words and word combinations (A) with their Russian equivalents (B)

A	B
electric vehicle	привод
to refer to	роторный гидромотор
propulsion	атомная энергия

nuclear power	управлять
rotary motors	электромобиль
scooter	продвигать вперёд
operate	электроприводная машина
propel	гусеничная машина
fossil fuel	относиться к
electric drive vehicle	приливная энергия
internal combustion engine	ископаемое топливо
tidal power	самокат
tracked vehicle	двигатель внутреннего сгорания

3.9. Mark the statements as True or False (F). Read the text from 3.3 again to check your answers

1. An electric vehicle is a device with one engine for propulsion and it is also referred to an electric drive vehicle.
2. The motion can be provided using both wheels and propellers driven by rotary motors.
3. An electric drive vehicle uses electricity which comes from sources such as batteries or generator.
4. The energy can come from different sources such as fossil fuels, wind, solar, nuclear power and etc.
5. The energy is supplied to the vehicle from refueling stations as it is stored in special separate tanks.
6. Electric vehicles consist of garages, subways, refueling stations and even network of mobile stations.

3.10. Fill in the gaps with appropriate words and phrases from the text.

1. A …… is a vehicle with one or more electric motors for propulsion.
2. Unlike an …… that is tuned to specifically operate with a particular fuel such as …… .
3. This ……..allows the drive train of the vehicle to remain the same while the …….. can be changed.
4. The electricity used to …….. the vehicle may be provided in many different ways.
5. Electric vehicles can include …….

Speaking

3.11. Work with a partner. Ask him/her if he/she has an electric vehicle of his/her own? What type of electric vehicle does he/she have? What are advantages and disadvantages of electric vehicles?

Writing

3.12. Fill in the table

Advantages	Disadvantages

Unit 4

Before you read

4.1. Answer the following questions and discuss in pairs.

1. What does zero emission vehicle look like?
2. In what spheres can they be used?

4.2. Read the text and compare your answers with the information from the text.

FUEL CELL VEHICLES-THE ZEVS OF THE FUTURE?

Another type of Zero-Emission Vehicle is the fuel cell powered vehicle. When the fuel cells are fueled with pure hydrogen, they are considered to be zero-emission vehicles. Fuel cells have been used on spacecrafts for many years to power electric equipment. These are fueled with liquid hydrogen from the spacecraft's rocket fuel tanks.

Fuel cell vehicles turn hydrogen fuel and oxygen into electricity. The electricity then powers an electric motor, just like electricity from the batteries powers the motor of an electric vehicle. Fuel cells combine oxygen from the air with hydrogen from the vehicle's fuel tank to produce electricity. When oxygen and hydrogen are combined they give off energy and water (H2O). In fuel cells this is done without any burning (combustion).

There are a number of ways that hydrogen can be provided to the fuel cells. One way is simply to put hydrogen gas into the fuel cell, along with

air. Hydrogen gas can come from gaseous or liquid hydrogen stored on the vehicle.

To carry gaseous hydrogen on a vehicle, it must be compressed. When compressed (usually to a pressure of about 3.000 pounds per square inch), it must be stored in special high-pressure containers. This is similar to the way compressed natural gas is stored on natural gas-fueled vehicles.

Many people in the vehicle manufacturing business think that fuel cell vehicles may be the technology of the future. However, a lot of work have to be done to make fuel cell vehicles perform well enough to replace the internal combustion engine in the vehicles we use today. They also will need to be made much less expensive.

At present, fuel cell vehicles have been developed to what might be called the pre-prototype stage. That means there are very few fuel cell vehicles in existence, and all of them are actually used for testing. Most car manufacturers have been or are working on demonstration models, some of which can reach a speed of 90 mph and can travel up to about 280 miles before they need refueling. DaimierChrysler has developed the **NECAR 4** and Ford calls its demonstration model **P2000 Sedan.** Some manufacturers claim they will have fuel cell cars available for the public in the next ten years.

4.3. Read and learn the vocabulary.

1. ZEV- zero emission vehicle	**транспортное средство с нулевым излучением**
2 fuel cell.	**топливный бак**
3. emit, v.	**излучать, выделять**
4. give off	**извергать, выбрасывать**
5. combustion	**горение, сжигание**
6. gaseous	**газовый, газообразный**
7. store, v.	**хранить, сохранять**
8. compress, v.	**сжимать, сдавливать**
9. manufacture, v.	**производить**
10. manufacturer, n.	**производитель**
11. prototype	**первоначальный, первообразный**
12. actually, adv.	**фактически, в действительности**
13. claim, v.	**заявлять, требовать**
14. available, adj.	**наличный, имеющийся в распоряжении**

Comprehension

4.4. Read the text again and decide whether these statements are *true* (T)or *false* (F).

1. Zero-emission vehicles are those that work with pure hydrogen.
2. Fuel cell vehicles take electricity from batteries.
3. There is the only way that hydrogen can be provided to the fuel cells. It is simply to put hydrogen gas into the fuel cell.
4. According to many car manufacturers fuel cell vehicles are the future of the technology.
5. Nowadays there exist a great amount of fuel cell vehicles in the world
6. In future fuel cell cars will be at the disposal of the public.

Vocabulary development

4.5. Match the words with their definitions.

1. store	a. really, in fact
2. compress	b. device for producing electric current by chemical action
3. give off	c. process of burning
4. cell	d. force sth. into a smaller space, press sth. together
5. actually	e. keep
6. combustion	f. produce sth., e.g. smoke, smell

4.6. Match the words from two columns to make word combinations.

1. give off	a. electricity
2. produce	b. vehicles
3. high-pressure	c. speed
4. gas-fueled	d. energy
5. reach	e. containers

4.7. Word-Building. Fill in the table.

noun	**verb**
	manufacture
emission	
production	
	store
	compress

4.8. Use a verb or a noun from the table to fill the gaps.

1. The car was ____ in Germany until 1961.
2. U.S. _____ of carbon dioxide are still increasing.
3. Behind the factory is a machine that ____ old cars into blocks of scrap metal.
4. He will not have his furniture in ____.
5. Most caustic soda is used in the ____ of aliminium.

Grammar revision

4.9. Skim through the text to find examples of using gerund, Participle I, Participle II, Infinitive. Translate the sentences and state the functions of the non-finite forms of verb.

4.10. Fill in the gaps choosing between the Infinitive or Gerund of the verbs in the box.

manufacture	claim	store
emit		compress

1. The group of scientists suggested … a new device.
2. High-pressure containers are used for … gaseous hydrogen.
3. The manufactures want … our attention.
4. Zero-Emission vehicle is a vehicle operated without …exhaust fumes.
5. In order … this substance it must be warmed up.

Speaking

4.11.Work in pairs. Discuss advantages and disadvantages of using Fuel Cell Vehicles. Then all together fill the table.

advantages	disadvantages

Unit 5

Before you read

5.1. Answer the following questions.

1. What is mechatronics?
2. What do mechatronics engineers do?
3.What careers can people make in mechatronics engineering?

5.2. Read the text and compare your answers with the information given in the text.

MECHATRONICS ENGINEERING

Every day you come into contact with the products of mechatronics engineering: modern cars, CD and DVD payers, microwave ovens, dishwashers, clothes washing machines, even some electric jugs. The processes and production lines used to make these and many other products are also mechatronic in nature.

The term "mechatronic" means that the product or production process involves a mechanical structure containing actuators(usually motors to make things move), a microprocessor to control the overall operation of the system, sensors to allow the microprocessor to monitor the state of the system and the electronics to connect the other parts together.

In the past, mechanical devices(think of a mechanical watch powered by a spring), computers(the old main frame computers calculating the payroll for large companies) and electronics(a hi-fi amplifier or radio set) were designed by engineers who were experts in only one area.

To design mechatronic products, an engineer must be familiar with mechanical engineering, computing, electronics and how these elements can be successfully combined. These are the skills that the Monash mechatronics engineering will teach you, along with knowledge of management and manufacturing processes.

Mechatronic devices have many advantages over their older counterparts. They can be given improved functionality. They can be self-adjusting so that, although manufactured to wider tolerances(and hence cheaper to make) they function better than the non-mechatronic equivalent. The intelligent use of sensing allows mechatronic white goods such as clothes dryers to adjust their operation based on the dampness of the clothes. Washing machines can sense the amount of dirt in the washing load and vary their use of water and electricity to suit, and chemical sensors in microwave ovens can monitor the smell of food to ensure that it is cooked perfectly.

Mechatronics is at the cutting edge of the development of new products, devices and processes. Mechatronic engineers work in teams designing mechatronic products or upgrading existing devices by adding mechatronic elements to improve their performance. They are involved in the design, construction and running of the factory production lines and processes, where they use their skills in computers, microcontrollers, programming,

industrial sensors, hydraulic, pneumatic and electric drivers, design of mechanical structures and mechanism and knowledge of manufacturing processes.

Graduates are equipped with the knowledge, skills and attitudes to design, build and operate the intelligent products and systems of today and tomorrow. The applications for mechatronics engineering are virtually unlimited. The need for professionals in this rapidly growing discipline is increasing and graduates are in high demand, particularly in South-East Asia. There are also many research opportunities for mechatronics engineers in nanotechnology, robotics, bioengineering and many other developing fields.

Vocabulary

1. electric jugs	приёмники
2. overall, adj.	общий, полный
3. spring, n.	пружина
4. amplifier, n.	усилитель
5. counterpart, n.	эквивалент
6. adjust, v.	отрегулировать, адаптировать
7. self-adjusting, adj.	с автоматической регулировкой, самонастраивающийся
8. tolerance, n.	допустимое отклонение
9. dampness, n.	влажность, сырость
10. lawn mowers	газонокосилки
11. hydraulic, adj.	гидравлический
12. pneumatic, adj.	пневматический

Vocabulary development

5.3. Find the words in the text according to the following definitions.

1. At the newest and most exciting stage in the development.
2. Worked by the pressure of a liquid, esp.water.
3. get used to a new situation.
4. A thing similar or corresponding to another.
5. Device that makes sounds or radio signals louder.
6. Including or concerning everything
7. Filled with air, worked by air under pressure.
8. Length of coiled wire which returns to its shape after being pulled or pressed.

5.4. Match a verb and a noun to make verb patterns.

Verb	noun
1. come into	a. a structure
2. involve	b. operation
3. connect	c. performance
4. adjust	d. products
5. improve	e. contact
6. create	f. parts

5.5. Make up a sentence using a verb pattern from 5.4.

5.6. Fill in the missing adjectives.

1. … sensors.
2. ….jugs.
3. … devices.
4. … drives.
5. ….controllers.
6. … products.

5.7. Fill in the prepositions from the box.

with	into	on	at	over	for

1. have advantages … .
2. come … contact.
3. …. the cutting edge.
4. must be familiar … .
5. the application … mechatronics engineering.
6. based … the dampness of the clothes.

Writing

5.8. Scan the text and write down the key-words.

5.9. Sum up the text using the key-words.

Compiled by Guzheva E. V. (Units 3, 4),

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MODULE VI

Faculty of Radio Engineering and Electronics

Unit 1

Before you read

1.1. Answer the questions

1. Do you remember when the University was founded?
2. How many faculties did it have at that time? Can you name these faculties?
3. When was the first group of students enrolled at the faculty of radio Engineering and Computer Science? How many students were enrolled at your faculty?
4. Since what time has the faculty been functioning?

1.2. Read the text

FACULTY OF RADIO ENGINEERING AND ELECTRONICS

In the early 1950s, in Western Siberia there was a pressing need for competent radio engineers who could solve challenging research and engineering problems arising in designing new radio and electronic facilities. To meet the needs, Novosibirsk Electrical Engineering Institute (now NSTU) started to train students in radio engineering in October 1953. Later in 1955, the department of theoretical radio engineering was set up and since that time it has been the centre of training radio engineers in Novosibirsk. During the five years of its development the conditions for opening other radio engineering departments were created. As a result, the department of antenna-feeder devices (now the department of radio physics), department of radio receiving and transmitting equipment and department of design and construction of radio electronic facilities branched off.

The faculty was formed on the basis of the Radio Engineering, Physical Engineering and Electronic Engineering Faculties in October 1953. One of

the advantages of this joining was to provide students with the opportunity to more precisely choose the area of specialization and the subarea he/she wants to explore in depth.

Vocabulary

1. pressing	насущный
2. need	необходимость
3. facilities	возможности
4. to set up	основывать
5. development	развитие
6. to create	создавать
7. device	устройство
8. transmitting	передающий
9. equipment	оборудование
10. to branch off	отделяться
11. opportunity	возможность
12. depth	глубина

Comprehension

1.3 Decide whether the sentences are true (T) or false (F)

1. NSTU stands for Novosibirsk Electrical Engineering Institute.
2. The institute was founded in 1963.
3. The institute started to train students in radio electronics during the five years of its development.
4. The faculty was formed in October 1953.
5. There was a pressing need in radio engineers in Western Siberia.

1.4 Answer the following questions

1. Why was a new institute formed in 1953?
2. What was the first department at the faculty?
3. When were conditions for opening other radio electronic departments created?
4. What are the advantages of being students of the faculty?
5. On what basis was the faculty formed?

Grammar revision

1.5. In what functions are the ing-forms used?

1. People living in Japan have some customs different from ours.
2. He heard voices coming through the open window.

3. The channel linking the two seas is being built now.
4. The playing children were too noisy.
5. The sitting of the committee was to begin at 7p.m.
6. The stars shining in the dark sky seem blue.

1.6. Translate the sentences paying attention to ing-forms

1. The car needs repairing.
2. There are different ways of obtaining knowledge.
3. They spoke about their travelling to the South.
4. Smoking is not allowed here.
5. Reading is very important in obtaining knowledge.

Speaking

1.7. Retell the text using the following points as a plan

1. Pressing need for competent radio engineers in Western Siberia.
2. Setting up the faculty of radio electronics.
3. Departments of the faculty.
4. Advantages of the faculty forming.

Unit 2

Before you read

2.1. Answer the following questions

1. What subjects are studied at your Faculty during the first two years?
2. Why is a foreign language included into the curriculum?
3. What does B. Sc. (M. Sc.)stand for?
4. What major subjects will your study later?

2.2. Read the text.

During the two years of study students mostly gain basic knowledge necessary for their further professional training and education. They study engineering subjects, including profound study of mathematics, and physics and some humanities as well. A foreign language, preferably English, is also included into the curriculum. In their third and forth years students acquire professional knowledge and skills in the field chosen. Those who successfully complete their course work and pass the qualifying examination are awarded B.Sc. (Bachelor of Science) degree in the appropriate field. The graduates from the B.Sc. program can continue their studies in the Engineer's or M.Sc. Programs (1.5 and 2 years correspondently).

The graduates are given fundamental training in physics, mathematics, radio engineering and electronics. They master the skills to work with up-to-date research and technological equipment.

The main directions of training at the faculty are as follows: radio engineering, design and technology of electronic facilities, optotechnology, nanotechnology etc.

Vocabulary

1. necessary	необходимый
2. further	дальнейший
3. profound	глубокий
4. skills	навыки
5. to master	овладевать
6. up-to-date	современный

Vocabulary development

2.3. Find Russian equivalents to the following

1. Дальнейшая профессиональная подготовка
2. Гуманитарные предметы
3. Включать в учебный план
4. Приобретать профессиональные знания
5. В соответствующей области
6. Современное технологическое оборудование
7. Основные направления

Comprehension

2.4. Decide whether the statements are true (T) or false (F)

1. In their third and forth years students acquire knowledge and professional skills in the field chosen.
2. A foreign language is studied during 2 years only.
3. Humanities are not included into curriculum of the faculty.
4. The graduates from the B.SC program can continue their studies.
5. There are only two directions at the faculty.

2.5. Answer the following questions

1. What subjects do the students of the faculty study?
2. What are the humanities?
3. What humanities are taught to you?

4. Who can be awarded B.Sc. and M.Sc degrees?
5. How many years do engineers study?
6. What are the main directions of training at the faculty?

Grammar Revision

2.6. Put questions to the underlines words

1. Student gain basic knowledge.
2. A foreign language is included into the curriculum.
3. The graduates from B.Sc program can continue their studies.
4. They master the skills to work with equipment.
5. The students are given fundamental training.

2.7. Rewrite the sentences changing the Voice (Active/Passive)

1. The students of the faculty study fundamental subjects.
2. They pass qualifying examination.
3. They borrow all necessary books from the library.
4. They master foreign languages.
5. Humanities are also studied by future engineers.

2.8. Translate the sentences into Russian paying attention to modal verbs and their equivalents

1. I hope you will be able to do this yourself.
2. You may go away now; I'll finish the work myself.
3. He was not allowed to enter the hall after the third bell.
4. As he received a bad mark he had to go over the material again.
5. You were to meet her at the station at 4 p. m.

2.9. Summarise the text

Unit 3

3.1. Read the text and answer these questions

1. Why do broadcasters make programmes in HD?
2. What will cause interference in a digital TV?
3. What is the future of HD?

THE ERA OF HIGH DEFINITION TV

Broadcasting and television are now entering the era of High Definition (HD) – a transition as profound as the first introduction of television and the subsequent transition from black-and-white to colour television.

The benefits of HDTV can be summarized as follows:

High-definition television (HDTV) yields a better-quality image than standard television does, because it has a greater number of lines of resolution. The visual information is some 2-5 times sharper as the gaps between the scan lines are narrower or invisible to the naked eye. The larger the size of the television the HD picture is viewed on, the greater the improvement in picture quality. On smaller televisions there may be no noticeable improvement in picture quality.

Some disadvantages of HDTV should be also mentioned:

– Limitations to picture quality

In practice, the best possible HD quality is not usually achieved. The main problem is that many operators do not follow HDTV specifications fully. They may use lower bitrates or smaller resolution to pack more channels within the limited bandwidth, reducing video quality.

– Connector cables

Appropriate cabling must be used. Component video cables are RCA cables that are color coded for proper signal. They consist of three video cables (green, blue, and red), two audio cables (red and white), and they carry an analog signal. HDMI cables carry all the video and audio in one cable using a digital signal.

– Signal quality

Unlike in analog television broadcasting, in which interference causes only gradual image and sound degradation, interference in a digital television broadcast will freeze, skip, or display "garbage" information.

Nevertheless the future of high definition looks bright, not only because of broadcast television applications. There are many other consumer and entertainment options that will help to expand the market and make HD more commercially attractive. A selection of these applications includes:

- movie production;
- Digital Cinema – movie distribution and exhibition;
- high-definition DVDs for media and recording;
- Internet streaming and distribution;
- consumer home-movie making;
- medical applications;
- military and surveillance.

Some of the applications represented above will influence the evolution of broadcast television.

To conclude, the movie industry is pushing for higher resolutions both in acquisition and presentation. The technology is available now and consumer awareness of high definition is increasing.

Vocabulary

1. HDTV-High Definition TV- телевидение высокой точности, с высоким разрешением
2. profound -глубокий, основательный
3. transition -переход
4. to yield – производить
5. bitrates – скорость передачи двоичной информации
6. bandwidth – ширина ленты, полоса частоты
7. to skip – перескакивать
8. surveillance – надзор, наблюдение
9. downconverted-цифровой звуковой сигнал, преобразованный с понижением частоты

Vocabulary development

3.2. Match a verb and a noun to make word partners

Verb	**Noun**
1. to enter	a. HD specifications
2. to achieve	b. the market
3. to expand	c. the evolution
4. to influence	d. garbage information
5. to display	e. the era
6. to follow	f. HD quality

3.3. Match the words from A to the words from B to make pairs of synonyms

A	**B**
1. to use	a. affect
2. to expand	b. get
3. to reduce	c. apply
4. to influence	d. diminish
5. to acquire	e. grow
6. to increase	f. enlarge

3.4. Complete the following sentences with the words from exercise 3.3.

1. I didn`t intend to _____ the importance of her work.
2. You should be able to have an experience in electronics to _____ it in your new job.

3. It is known that poor housing significantly _____ educational achievement.

4. The professor _____ his experimental methods.

5. The cost of the project _____ substantially since it began.

6. It is necessary for him to _____ proper knowledge in the field of optotechnology.

3.5. Write the sentences in the Passive Voice using the appropriate verb from the box.

to shoot	to introduce	to satisfy	to convert
to produce	to restrict	to improve	to export

1. The USA is a well-known exporter of movies but, in addition, many of the so called "Soap" series …there and … worldwide.

2. The movie industry has been supported by 35 mm film, the parameters of which … steadily … over the years.

3. Over the past few years, several "blockbuster" movies have been shot entirely, or in part, using HD.

4. As technology improved and colour television ….,Europe migrated to 625 lines, 50 fields/sec.

5. Material produced in this way can also … to other formats for transmission.

6. Unfortunately European consumers … currently … to down-converted standard-definition versions.

7. Many consumers … not …. with this unused display area and choose instead to distort their standard definition shows by stretching them horizontally to fill the screen.

3.6. Use the verb in brackets in the appropriate form.

Before delving into the details of scanning formats for high definition, it (1.may be) of interest to briefly review the origins of television and their respective picture formats. One of the early pioneers of television (2.to be) John Logie Baird who (3.to introduce) television in to the UK with a 30 – line vertical mechanical scanning format. Despite refinements it (4.to be) of course inevitable that electronic scanning should become the mainstream. In the early 30s, the UK (5.to move) to 450 lines with a theoretical video bandwidth of 3 MHz. Germany, also an early pioneer of television, (6.to broadcast) the 1936 Olympic Games, using 180 lines, later moving to 441 lines. France (7.to start) with 441 lines and subsequently (8.to move) to 819 lines.

Unit 4

4.1. Scan the text "New Developments in Electronic Memories" and answer the following questions

1. What is memory?
2. In what way is main memory attached to the processor?
3. When did new memory technology emerge?

4.2. Read the text and fill in the gaps with the following sentences or their parts. There is one extra sentence which you do not need to use.

1. The difference in time between a register access and memory access is very great,
2. It means that products like personal computers could start up instantly,
3. Storing and retrieving data from a large block of memory is more time consuming than from a small block.
4. For which high speed is worthwhile in the first place.
5. Main memory is attached to the processor via its address and data buses.
6. Increases the data bus width to 64 bits, enabling it to access 8 bytes of data at a time.

NEW DEVELOPMENTS IN ELECTRONIC MEMORIES

The versatile capabilities that have made the computer the great success are due to exploitation of the high speed of electronic computation by means of stored programs. This process requires that intermediate results be stored rapidly and furnished on demand for long computations, **a)**._____.

Memory is the predominant computer subsystem. It is the storage medium used to hold the system`s operating instructions and the specific application programs in use.

Modern computers have significantly more memory than the first PC`s and this has had an effect on the development of the PC`s architecture. With a large amount of memory, **b)**._____, and this has resulted in extra layers of "cache" in the storage hierarchy and using clever electronics to ensure that the data the processor needs next is already in cache.

c)._____Each bus consists of a number of electrical circuits or bits. Every time a bit is added to the width of the

address bus, the address range doubles. In 1985, Intel`s 386 processor had a 32-bi address bus, enabling it to access up to 49B of memory. The Pentium processor – introduced in 1993-**d)**._____.

In the late 2000 IBM and German semiconductor company Infineon Technologies

AG announced plans to collaborate in the development of Magnetic Random Access Memory (MRAM)-a breakthrough memory technology that could significantly increase battery life of portably computing devices and lead to "instant-on" computers. Since MRAM also retains information when power is turned off, **e)**._____, without waiting for software to "boot up". Nonvolatility also means reduced power consumption. Since it will not need constant power to keep the data intact. MRAM could consume much less than established random access memory technologies, extending the battery life of cell phones, handheld devices, laptops and other battery powered products.

The technology could represent a serious threat to the various silicon-based memory chips towards 2010.

Vocabulary

1. versatile – многосторонний
2. exploitation – эксплуатация
3. predominant – преобладающий, доминирующий
4. to enable – давать возможность
5. breakthrough – крупное достижение, прорыв
6. instant- немедленный
7. to retain- удерживать, сохранять
8. intact – неповрежденный, целый
9. RAM (random access memory) – ЗУ с произвольной выборкой
10. ROM (read-only memory) – постоянное ЗУ
11. scratch pad- сверхоперативная память
12. cache- «кэш» память, сверхоперативная память
13. nonvolatility- энергонезависимость

Vocabulary development

4.3. Match the words (A) with he definitions (B)

A	**B**
1. to attach	a. a situation or activity that could cause harm or danger
2. amount	b. to get information, especially from a computer

3. threat	c. the ability to do something
4. capability	d. an important new discovery or achievement that comes after a lot of hard work
5. to access	e. to connect one machine or piece of equipment to another
6. breakthrough	f. a quantity of something

4.4. Fill in the gaps with the words from 4.3.

1. Any contract made under _____ of violence is not legal.
2. The database allows you _____ the sales figures in a number of ways.
3. Scientists predict a major _____ within the six months.
4. He _____a color printer to his computer.
5. The University provides student with some _____of resources and equipment.
6. These calculations are beyond _____ of even the most advanced computers.

Grammar revision

4.5. Complete the following sentences using the correct forms of the verb in brackets.

1. Never before man……. (to possess) a tool comparable to a computer.
2. Access time ……. (to be) simply the time it (to take) to read or write at any storage location.
3. Quantum Science Research group …… .(to create) the highest density electronically addressable circuit.
4. Semiconductor memories ……. (to be) extremely versatile and highly compatible with other electronic devices.
5. In the early 1970`s semiconductor memory cells that served the same purpose as cores ……. (to develop).
6. The core memory (to become) the main internal computer memory.
7. In the early1950`s the core memory (to replace) these early devices.

4.6. Translate the sentences paying attention to the –ing forms.

1. Associative memories can be used for compiling, job assignment and parallel processing.
2. The computer spends a goodly amount of its time doing exactly this: performing math operations and translating information from one form to another.

3. RAM, wherein each memory word is accessed for reading or writing via a specific address.

4. Programmable ROMs can be written using special equipment.

5. Some applications require random access memories containing permanently stored or rarely altered information.

6. A read-only memory can be obtained by replacing the storage capacitor in a one transistor memory cell with either an open circuit or a connection to ground, thus representing one or the other of the two binary states.

7. This memory is read and written by entirely electronic means, but before a write operation all the storage cells must be erased to the same initial state by exposing the packed chip to ultraviolet radiation.

8. Should an error occur for any reason during the running of the program, the program terminates by indicating what the error number is.

9. The data and address memory cells together record one word of cashed data and its corresponding address in main memory.

10. With the development of integrated circuits the first trend toward large-scale integrated circuits was the development of scratch pad memories using bipolar transistors.

Speaking

4.7. Speak on new developments in sphere of television and broad casting

Unit 5

Before you read

5.1. Answer the questions

1. Have you heard anything about nanotechnology?
2. Do you know the meaning of the prefix “nano”?
3. Do you know its origin?
4. Where and how can nanotechnologies be applied?
5. What is known about the affect of nanotechnologies on the environment?
6. Can you interpret the title of the article?

5.2. Read the text

NANOTECHNOLOGY: HOW THE SCIENCE OF THE VERY SMALL IS GETTING VERY BIG

(written by Mario Ritten)

The history of nanotechnology begins in the 1950s and 1960s. Nanotechnology gets its name from a measure of distance. A nanometer, or nano, is one-thousand-millionth of a meter. This is about the size of atoms and molecules. Nanotechnologies work with materials this small. Many experts credit the idea to physicist Richard Feynman. In ninety fifty-nine, this Nobel Prize winner gave a speech. He called it "There's Plenty of Room at the Bottom". In his lecture he described how the entire Encyclopedia Britannica could be written on the head of a pin. The term nanotechnology was suggested later by Norio Taniguchi of the Tokyo University of Science. The prefix "nano" comes from the Greek word "nanos", meaning "dwarf", i.e. very small.

Nanotechnology is defined as the science and technology of building electronic circuits and devices from single atoms and molecules, or the branch of engineering that deals with things smaller than 100 nanometers.

Nanomaterials.

Nanomaterials – materials having unique properties arising from their nanoscale dimensions can be stronger or lighter, or conduct heat or electricity in a different way. They can even change colour; particles of gold can appear red or blue, depending on their size. These special attributes are already used in manufacturing computer chips, CDs and mobile phones. Researchers are progressively finding out more about the nanoscale world and aim to use nanotechnologies to create new devices that are faster, lighter, stronger and more efficient.

Is nanotechnology good or bad?

Although nanotechnology is exciting, there are reasons for concern. A study by NASA researchers found that nano-particles caused severe lung damage to laboratory mice. Other studies suggest that nano-particles could suppress the growth of plant roots or could even harm the human body's ability to fight infection.

The Environment protection Agency says that as there is not much known about the affect of nano-structures on the environment, the governments need to develop rules for their usage.

Vocabulary

1. measure (n) – мера (длины, поверхности и т.д.)
2. measure (v) – измерять
3. measurement – измерение
4. about (adv) – приблизительно
5. to credit the idea to smb. – приписывать идею к-л.
6. physicist – физик
7. at (the) bottom – фактически
8. head of a pin – кончик иглы (головка булавки)
9. dwarf – очень маленький
10. property – свойство
11. arise (arose, arisen) (v) – возникать
12. conduct (v) – проводить (тепло, электричество)
13. particles – частицы
14. appear (v) – появляться
15. depend on (v) – зависеть от
16. specific attributes – характерные черты
17. find out (v) – узнавать
18. aim (v) – стремиться
19. device – прибор
20. exciting – захватывающий
21. reasons for concern – причины для беспокойства
22. cause (v) smth. – вызывать ч.-л., приводить к ч.-л.
23. lung damage – поражение легких
24. severe – тяжелый (заболевание)
25. suppress (v) – подавлять
26. affect (v) – влиять на
27. harm (v) – наносить вред, ущерб
28. environment – окружающая среда
29. need + inf. – нужно что-то делать
30. to develop rules – разработать правила (законы)

Comprehension

5.3. Answer the following questions.

1. What things does nanotechnology deal with?
2. When did Feynman make his speech?
3. Who do you think can receive a Nobel prize?
4. Who suggested the term “nanotechnology”?

5. Can you define what nanotechnology is?
6. Where are nanomaterials used?
7. What do you think of the future of nanotechnologies?
8. Do nanotechnologies offer only potential benefits to mankind? Can they do harm?

5.4. Fill in the gaps using the words from the text.

1. The history of nanotechnology … in 1950.
2. Nanotechnology …its name from a measure of distance.
3. Many scientists … the idea to Feynman.
4. Feynman … a Nobel prize winner.
5. Unique properties of nanomaterials … from their nanoscale dimensions.
6. Nanomaterials … colour.
7. Their special properties are already … in manufacturing chips.
8. There are reasons for … about human health.

5.5. Decide whether the statements are true (T) or false (F).

1. Nanotechnology gets its name from a measure of weight.
2. "Nano" means very large.
3. The term "nanotechnology" has been known since 1885.
4. It was suggested by a scientist from the Tokyo University of Science.
5. Nanotechnologies are used in making food.
6. There are no reasons for concern in using nanotechnologies.
7. They help men become stronger and healthier.
8. It is not known how nanotechnologies affect the environment.

Grammar revision

5.6. Put questions to the underlined parts of the sentences.

1. In the 1980s the idea of nanotechnology was conceptually explored by Dr. Drexler.
2. Drexler proposed the term "zettateck" which never became popular.
3. Richard Adolf Zsigmonday made detail study of nanomaterials with sizes down to 10 nm. and less.
4. Researchers are progressively finding out more about the nanoscale world.

5.7. Translate the sentences into Russian paying attention to the predicates in the Passive Voice.

1. Some of the concepts in nanotechnology were mentioned in 1867 by James Maxwell.
2. A first system classification based on particle size in nanometer range was developed by Zsigmonday.
3. The topic of nanotechnology was again touched upon by Richard Feynman.
4. The term "nanotechnology" was first suggested and defined by a Japanese professor.
5. The extremely small size of nanomaterials are much more readily absorbed by the human body.
6. Severe dangers can be brought by nanotechnologies, as their affect on the environment has not been studied yet.
7. New research programs on applying nanotechnologies have been launched.

5.8. Translate the sentences from English into Russian paying attention to modal verbs.

1. In 1965 Gordon Moore, one of the founders of Intel Corporation, said that the number of transistors that could be bit in a given area would double every 18 months for the next ten years.
2. The last quarter of a century could see tremendous advance in our ability to control and manipulate light.
3. Experts disagree on what should be called nanotechnology and what should not.
4. One can regulate the speed of their machine.
5. You may think whatever you like but nanotechnologies are our future.
6. The governments have to take measures to protect the environment.
7. The problem is to be discussed at the meeting of the committee.

Speaking

5.9. Retell the text using additional information from the Internet and other sources.

Compiled by Atamanova O. S. (Units 3, 4),
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MODULE VII

Physical Engineering Faculty

Unit 1

Before you read

1.1. Answer the following questions.

1. Why have you chosen this faculty?
2. What degree are you going to work for?
3. What are your plans for the future scientific career?
4. What is a "dream job "to you?

1.2. Read the following international words and check their pronounciation in a dictionary.

Physical, academician, basic, basis, electrophysics, dielectrics, accelerator, intensive, microelectronics, fundamental, reorganization, plasma, optical, rocketry, astronautics, conception, communication, unique, laboratory, laser, elementary, theoretical, optotechnololgy, photonics, location, innovation, guarantee, concept, creative, selection.

1.3. Match the words to their explanations.

1. set up	a. do
2. undergo	b. experience the process of change
3. be aware	c. give the evidence of
4. urgent	d. about things you need to do quickly
5. be capable	e. establish
6. carry out	f. able to do

1.4. Read and learn the following terms.

1. Siberian Branch of Russian Academy of Sciences (SB RAS)	Сибирское отделение Российской Академии наук (СО РАН)
2. nuclear physics	ядерная физика
3. engineering physics	техническая физика
4. electrophysical installation	электрофизическая установка
5. accelerator technology	ускорительная техника

6. charged particle beam physics	физика пучков заряженных частиц
7. knowledge-intensive technologies	наукоемкие технологии
8. landmark(n)	веха
9. undergo(v)	подвергаться
10. involve(v)	включать
11. applied(adj)	прикладной
12. astronautics(n)	космонавтика
13. correspond (v)	соответствовать
14. assign(v)	назначать
15. adviser (n)	советник, *зд.* руководитель
16. supervise (v)	наблюдать
17. conduct(v)	проводить
18. independent (adj)	независимый
19. approach (n)	подход
20. state-of –the-art	использующий новейшие идеи, технику

1.5. Read the text for the basic information about the faculty.

PHYSICAL ENGINEERING FACULTY

The Physical Engineering Faculty was set up in 1966. The founding fathers of the faculty were Academician G.I. Budker, Director of the Institute of Nuclear Physics (SB RAS), and Professor G.P. Lyshchinsky, Rector of Novosibirsk Institute of Electrical Engineering. They were aware that it was the discoveries in physics that formed the basis of new technical development. They realized the urgent need of training specialists in engineering, electrophysics, semiconductors, dielectrics being capable of carrying out research work independently.

At the very beginning the faculty headed by E.S.Samoilov, Candidate of Sciences, consisted of one department: the Department of Electrophysical Installations and Accelerators with Professor E.A. Abramyan being its first head. The faculty continued growing very intensively. Up to 1992 the faculty included 4 departments: the Department of Semiconductor Devices and Microelectronics, the Department of Applied and Theoretical Physics, and the Department of Fundamental Physics added to the first one – the Department of Electrophysical Installations and Accelerators.

1992 is considered to be another landmark in the history of the faculty.

As a result of the university reorganization the faculty structure underwent fundamental changes too. Firstly, it was reduced to two departments: the Department of Electrophysical Installations and Accelerators and the Department of Laser Systems. Secondly, two institutes of the Siberian Branch: the institutes of Nuclear Physics and Laser Physics became the basic institutes of the faculty. This fact was of great importance as from that time on training in these fields has been provided on the basis of the newest information and facilities of these two leading research centers.

At present the faculty, headed by Professor A.K. Dmitriyev, Doctor of Physical-Mathematical Sciences, has four departments:

– Applied and Theoretical Physics,
– Optoinformation Technologies,
– Electrophysical Installations and Accelerators,
– Laser Systems.

The teaching staff is highly experienced and qualified. Among them there are 53 Candidates of Sciences and 38 Doctors of Sciences. There are also 24 Professors and 3 Honored Artists.

The faculty introduced the multilevel system of education awarding B.Sc. degrees in the fields of physics, engineering physics, optotechnology, photonics and optoinformatics, innovations.

Students are offered the following areas of specialization leading to M.Sc. degrees in physics:

– nucleus and elementary particles physics;
– plasma physics;
– accelerator physics.

Some students choose the following areas of specialization with M.Sc. degree awarded:

– optical systems of location,communication and data processing,
– physics of optical phenomena.

The faculty also trains highly qualified specialists (engineers) in the following fields:

– laser systems in rocketry and astronautics;
– optoelectronic devices and systems,
– cameramanwork (this leads to the profession of a television cameraman).

During the first two years students are given fundamental training in basic subjects: profound training in physics and mathematics, and knowledge of the present-day methods of experimental research, methods and technical

facilities for automatic data processing and data collection.

From the third year of study students of the faculty are given training both at the university and the basic research institutes. They are assigned an adviser and do supervised research. Students are involved in the research teams at the institutes' laboratories. Their term and degree papers are included in the research programs of the institutes' laboratories.

Many faculty graduates choose to continue their education and take postgraduate courses leading to Candidate of Sciences degrees, successfully defend their theses and join the staff of the INP and ILP (SB RAS) as well as of other scientific and educational institutions or manufacturing enterprises of our country and abroad.

Wide international relations of the SB RAS institutes, numerous research seminars and conferences, including those with the participation of foreign researchers, give students unique opportunities for professional growth.

Comprehension

1.6. Answer the following questions on the text.

1. When was the Physical Engineering Faculty founded?
2. Who were the founding fathers of the faculty?
3. What was the aim of setting up this faculty?
4. How do discoveries in physics promote technical innovations?
5. Who was the first dean of the faculty?
6. What was the name of the first department?
7. What were the four basic departments up to 1992?
8. Why is the year of 1992 considered to be a landmark in the history of the faculty?
9. How many departments are there in the structure of the faculty now?
10. What degrees does the faculty award?
11. What are the main directions of training B.Sc. students?
12. What are the main areas of specialization in physics?
13. What degrees can students get in such areas of specialization as optical systems of location, communication and data processing and physics of optical phenomena?
14. What spheres of technology does the faculty train engineers for?
15. Students can also get the profession of a television camera-man, can't they?
16. Are there any postgraduate programs?

17. Where can graduates continue their work and study?
18. What do you know about the teaching staff of the faculty?
19. What is the role of the basic research institutes in training and research work at the faculty?

1.7. Complete the following sentences.

1. The Physical Engineering Faculty was set up in…
2. The founding fathers of the faculty were ……
3. The founding fathers were sure that the discoveries in physics ….
4. They realized the urgent need of…
5. The first dean of the faculty was…
6. The faculty consisted of the only department of…..
7. The faculty continued……..
8. Till 1992 the faculty consisted of the 4 following departments…..
9. The year of 1992 is considered to be …..
10. Firstly, the faculty structure was….
11. Secondly, the Institutes of Nuclear Physics and Laser Physics became…
12. This event was of great importance because…….
13. Now the faculty comprises 4 departments. They are…..
14. The faculty introduced multilevel….
15. The main directions of training are….
16. The main areas of specialization are….
17. Students can obtain qualification of an engineer in….
18. Those who choose cameramanwork can get the profession of a ……
19. During the first 2 years students are given fundamental training in….
20. From the third year students are given….
21. The faculty graduates may….
22. The staff……

1.8. Fill in the gaps.

I study at the faculty of _____. The dean of our faculty is_____. The faculty was founded in_____. Its founding fathers were _____ and _____. The aim of its foundation was to train specialists in _____ capable of _____. At the beginning there was only _____ department. It was _____. Now the Physical Engineering Faculty consists of_____departments. They are:

1._____
2._____

3._____
4._____
During its history the faculty _____several changes. One of the most important was in _____ when two institutes of SB RAS became the _____institutes. The training process is unique. It is based on such_____as:
-careful selection of the most talented young people,
-active participation of leading researchers in the training process,
-individual _____to students,
-forming _____atmosphere for study and _____ corresponding to the key concepts.

Thus during the first two years students are given _____. From their third year students are given training both _____ and_____. Competent and _____teaching staff work at the faculty. It includes 53_____ and 38_____.
After graduation from the university students have_____opportunities of getting _____ jobs.

Speaking

1.9. Make up short reports on subthemes using key words and word combinations given below.

1. The history of the faculty

To be set up, necessity, founding fathers, discoveries in physics, to form the basis of, to train specialists in, to be headed by, the only department, to consist of, to be a landmark, firstly, secondly.

2. The faculty structure, areas of specialization

The dean, 4 departments, to introduce, directions of training (B.Sc. degrees), specializations (M.Sc. degrees), specialists (engineers), profession (television cameraman).

3. Training process conceptions, curriculum

Training process concepts, subjects, to participate in research work, to be assigned, to be given, fundamental training, adviser, to pay attention to, to do supervised research, to be involved in, to participate in.

4. Job opportunities for graduates

To take postgraduate courses, to continue one's work.

Unit 2

Before you read

2.1. Discuss in small groups.

1. What are the two basic research institutes of the Faculty?
2. What do you know about the Institute of Nuclear Physics (INP)?

2.2. Read the text and choose the best title for it.

A Academician G.I. Budker
B Research in high-energy physics
C The Institute of Nuclear Physics

INSTITUTE OF NUCLEAR PHYSICS

The Institute of Nuclear Physics (INP) is one of the world-leading centres in high-energy physics, controlled thermonuclear fusion and applied physics. It is one of the first institutes of the Siberian Branch of Russian Academy of Sciences. The institute was founded in 1958. It originated from the Laboratory of New Acceleration Methods of the Atomic Energy Institute (IAE), headed at that time by I.V. Kurchatov.

A brilliant representative of Kurchatov's school was G.I.Budker, who had become the laboratory's head in 1953. The primary subjects studied in Budker's laboratory were physics and technology of intense electron beams. The progress made and experience gained in this field soon enabled the design and construction of installations with colliding electron-electron and, later, electron-positron beams. Due to this capability there appeared a new direction in the experimental study of elementary particles. In 1968 at the International Conference held in Novosibirsk physicists were called on to start developing a new thermonuclear reactor.

G.I. Budker proposed a breathtaking idea of a fundamentally new approach to the study of physics at high energies – linear colliding electron-positron beams. That idea became a basis for INP's further development. With the aim of putting into practice the achievements of modern physics and great experience gained by the Institute, G.I. Budker initiated the design and construction of a series of special electron accelerators for the use in radiation technologies. These accelerators opened up basically new possibilities for various branches of national economy. At present, the research activity of the institute is developing in 3 main directions:

– the development of new methods of acceleration of charged particles and creation of new accelerators for scientific and industrial purposes;

– research in high-energy physics using new accelerators;
– research in controlled thermonuclear fusion.

At present the Institute has 30 research laboratories and sectors. The total number of research staff of the Institute is about 490 and among them there are 50 Doctors of Science and more than 160 Candidates of Science, 4 full members and 6 corresponding members of the Russian Academy of Sciences. The head of the Institute is academician I.A. Skrinsky.

The researchers regularly publish scientific papers and organize scientific meetings at various levels, from International and National Conferences to local workshops and meetings of specialized working groups.

Special emphasis is placed on international contacts of the Institute. Here contacts are maintained with leading centres and laboratories. For example, for many years the Institute has been maintaining close scientific relations with the European Centre for Nuclear Research (CERN, Switzerland). The experience obtained at CERN is being applied to new collider projects undertaken at the Institute. One of the latest fields of research is investigation of free-electron laser and its application in biology and industry.

Vocabulary

1. high-energy physics – физика высоких энергий
2. controlled thermonuclear fusion – управляемая термоядерная реакция
3. to originate – происходить, брать начало
4. electron beam – электронный пучок/луч
5. to enable – делать возможным
6. to collide – сталкиваться
7. colliding electron-positron beam – встречные пучки электронов и позитронов
8. charged particle – заряженная частица
9. free-electron laser – лазер на свободных электронах
10. to undertake – предпринимать

Vocabulary development

2.3. Match the words with their definitions.

1.	originate	a.	the ability to do something
2.	capability	b.	the process in which atoms combine to form nuclear energy

3.	call on	c.	a particular way of thinking or doing something
4.	approach	d.	to officially ask somebody to do something
5.	fusion	e.	to begin to exist or appear for the 1st time
6.	initiate	f.	to make something start
7.	installation	g.	a system or piece of equipment that has been made ready for use

2.4. Give English equivalents.

1. управляемая термоядерная реакция
2. яркий представитель научной школы Курчатова
3. интенсивные электронные пучки
4. установки на встречных пучках электронов и позитронов
5. разрабатывать новые методы ускорения заряженных частиц
6. поддерживать тесные научные связи
7. предложить захватывающую идею
8. создание новых ускорителей для научных и промышленных целей.

Comprehension

2.5. Complete the sentences.

1. G.I. Budker was_____ of Kurchatov's school.
2. The main subject of Budker's laboratory was the physics of_____.
3. The use of linear colliding electron-electron beams has greatly contributed to the study of_____.
4. Special _____ were designed and constructed for different purposes.
5. _____ is considered to be a promising source of energy.

2.6. Check your understanding of the text answering the following questions.

1. What is the INP famous for?
2. What did the institute originate from?
3. What was the main subject of research in Budker's laboratory?
4. What installations could be designed and constructed based on the research conducted?
5. What new approach was elaborated to the study of high-energy physics?

6. What are the main directions of scientific activity of the INP now?

7. What is the qualification of the research stuff working at the institute?

8. What leading centres does the INP maintain scientific contacts with?

Writing

2.7. Write a short essay about the Institute of Nuclear Physics (80-100 words).

UNIT 3

Before you read

3.1. Discuss these questions in small groups.

– In chemistry and physics, what is an atom?
– What is the structure of an atom?
– What happens if you split an atom?

3.2. Read the text for the main ideas.

THE ATOM

The ancient Greeks were the first to use the term *atomos,* meaning the smallest possible separation of matter. But it was first hypothesized scientifically by the British chemist John Dalton (1766-1844) when he suggested it was the smallest particle that could exist. Since then, smaller subatomic particles have been discovered and the part they play as the basic building blocks of the universe is clear. We now know that atoms are made up of differing numbers of electrons, neutrons and protons, and these too are made up of even smaller particles.

Dalton's theory about atoms was not immediately accepted by chemists. However, we know now that Dalton was correct in almost everything he said in his theory of the atom. He described an atom, even though he had never seen one, as a particle that cannot change its nature. It could, he observed, combine with the atoms of other chemical elements to create a compound. Almost a century later the first subatomic particles were discovered. By the 1930s, physicists were working with new ideas which allowed them to investigate the parts of the atom in great detail. In turn, these develop-

ments helped them to develop quantum mechanics – the basis of both modern chemistry and physics.

In chemistry, the atom is the smallest part of an element that can still be recognized. An example will explain best of all. Each element is identified by the number of protons it has. An atom of carbon has six protons. Those six protons without the neutrons and electrons, or the electrons without the other subatomic particles are simply subatomic particles; they are not carbon. A carbon atom can be combined with two atoms of oxygen to give the compound carbon dioxide, or $C0_2$. It is this difference in the number of subatomic particles that makes one atom different from another.

Subatomic particles also have another purpose. If there is the same number of electrons and protons in the atom, then the atom will be electronically neutral. A difference between the two means the atom has an electrical charge, in other words, it produces electricity. This electricity means the electrons can become attracted to each other. In this way, atoms can bond together to form molecules, and when enough molecules are joined together we have matter that we can see.

The most recent theories of the origin of the universe say that all the atoms in the universe were formed in the first few minutes of the universe coming into existence. The most common element is the simplest, hydrogen, which has the atomic number 1. Seventy-five per cent of all atoms are hydrogen atoms. The next most simple is the next most common, helium, atomic number 2 making twenty-four per cent of all atoms. All the other atoms add up to just one per cent of everything that exists in the universe.

Vocabulary

1. separation	разделение
2. matter	вещество, материал
3. to hypothesize	строить гипотезу
4. to exist	существовать
5. to accept	принимать
6. compound	соединение
7. to recognize	признавать
8. particle	частица
9. to attract	притягивать
10. bond	соединять

Vocabulary development

3.3. Read the following international words and check their pronunciation in a dictionary.

Carbon dioxide, electron, helium, hydrogen, molecule, neutron, proton, quantum mechanics, subatomic, universe

3.4. Match these words with their definitions.

1. subatomic	A) part of an atom which has no charge
2. electron	B) two or more atoms
3. neutron	C) smaller than an atom
4. molecule	D) part of an atom that has a negative charge
5. proton	E) a theory developed by physicists to explain the atom
6. quantum mechanics	F) part of an atom which has a positive charge
7. carbon	G) pulled together
8. attracted	H) a chemical element
9. helium	I) a chemical element that is lighter than air
10. universe	J) the whole cosmos

Comprehension

3.5. Choose the correct answer and complete the sentences.

1. Dalton believed the atom to be
   A) an element. B) made of smaller particles.
   C) the smallest possible particle. D) his own idea.
2. Dalton's theories were
   A) generally accepted. B) not tested very carefully.
   C) accepted at once. D) not correct.
3. The number of protons in an element
   A) is the same as the number of electrons. B) is always six.
   C) never changes. D) characterizes the element.
4. Electrons help
   A) protons to form elements. B) atoms to be neutral.
   C) molecules to become atoms. D) atoms to form molecules.
5. Hydrogen is
   A) the simplest atom there is. B) present in all atoms.
   C) the oldest atom. D) as common as helium.

Writing

3.6. Write a short essay on the steps of atom structure study (80-100 words).

Unit 4

Before you read

4.1. Answer the following questions.

1. Your future research work will be connected with optical devices, namely lasers. What is LASER?

2. What types of lasers exist?

4.2. Give the translation of the following terms from the text below. Use the dictionary if necessary.

1. energized atoms
2. light amplification
3. stimulated emission
4. exited state
5. light released
6. solid state lasers
7. pumped
8. gas lasers
9. visible red light
10. semiconductor lasers
11. dye lasers
12. diode lasers
13. use low power
14 discharge

4.3. Read the text and find the answers to the questions of 4.1.

LASER BASICS

Lasers play a pivotal role in our everyday lives. The fact is they show up in an amazing range of products and technologies. You will find them in everything from CD player to dental drills, from high-speed metal cutting machines to measuring systems. Tattoo removal, hair replacement, eye surgery – they all use lasers. But what is a laser? What makes a laser beam different from the beam of a flashlight? What are the main types of lasers?

Let's start with the fundamentals of laser technology.

A laser is a device that controls the way that energized atoms release photons."Laser" is an acronym for light amplification by stimulated emission of radiation. In a laser, the lasing medium is "pumped" to get the atoms into an exited state. Typically, very intensive flashes of light or electrical discharges pump the lasing medium and create a large collection of exited-state atoms (atoms with higher-energy electrons). It is necessary to have a large collection of atoms in the exited state for the laser to work efficiently.

Laser light has the following properties:

– the light released is monochromatic it contains one specific wavelength of light (one specific colour);

– the light released is coherent it is "organized" – each photon moves in

step with the others;

– the light is very directional. A laser light has a very tight beam and is very strong and concentrated. A flashlight, on the other hand, releases light in many directions and the light is very weak and diffuse. To make these three properties occur takes something called *stimulated emission*. This does not occur in your ordinary flashlight – in a flashlight, all of the atoms release their photons randomly. In stimulated emission, photon emission is organized. The other key to a laser is a pair of mirrors, one at each end of the lasing medium. In the process, they stimulate other electrons to make the downward energy jump and cause the emission of more photons of the same wavelength and phase.

There exist some different types of lasers. The laser medium can be a solid, gas, liquid or semiconductor. Lasers are commonly designed by the type of lasing material employed.

Solid-state lasers have lasing material distributed in a solid matrix (such as the ruby).

Gas lasers (helium and helium-neon are the most common gas lasers) have a primary output of visible red light.

Excimer lasers (the name is derived from the terms *excited* and *dimers*) use reactive gases (chlorine) mixed with inert gases (argon and xenon).

Dye lasers use complex organic dyes in liquid solution as lasing media.

Semiconductor lasers or diode lasers. These electronic devices are very small and use low power.

Thus, a laser is created from light, and the resulting laser light has special properties that are unique and different from regular light. A laser can be of different types and strengths. A laser can be very tiny so as to be almost invisible, and can be very large so as to occupy an entire room. The laser is indeed a very useful and exciting invention, with many beneficial applications and uses.

Vocabulary

1. emit (v)	испускать, излучать (свет)
2. emission (n)	испускание (света), эмиссия
3. emitted (adj)	излученный
4. release (v)	испускать, выбрасывать
5. amplify(v)	усиливать
6. amplification (n)	усиление
7. stimulate (v)	возбуждать, индуцировать
8. wavelength (n)	длина волны

9. flashlight (n) мигающий свет, электрический фонарик
10. output (n) мощность
11. lasing medium среда, генерирующая в оптическом диапазоне
12. lasing material вещество, излучающее в оптическом диапазоне

4.4. Match the fields of laser applications with their definitions.

1. dental drills	a. To put hair back to its proper place
2. tattoo removal	b. Medical operation on people' s eyes
3. high-speed metal cutting	c. A small, high-speed tool used in dentistry to remove decayed tooth material prior to the insertion of a dental filling
4. hair replacement	d. The process of taking away a permanent picture drawn on a part of your body by putting ink into your skin with a needle.
5. eye surgery	e. Very quick operations aimed at dividing metal material into pieces

4.5. Match the words similar in the meaning.

1. extremely	a. straight
2. efficient	b. dispersed
3. extraordinary	c. unplanned
4. move in step	d. pivotal
5. tight	e. amazing
6. diffuse	f. operate in conformity
7. randomly	g. effective

4.6 Read the text 4.3 again and answer the following questions.

1. What is a laser?
2. What fields of human activity are the lasers used in?
3. What is the difference between regular and laser light ?
4. What types of lasers have you learned about from the text?
5. What do you think about the prospects of laser applications?

Unit 5

Before you read

5.1. Read and memorize the following terms.

1. fiber/fibre (n)	волокно
2. fiber optics	оптоволоконная техника
3. loss (n)	потери
4. immune (adj)	устойчивый
5. interference (n)	помехи, интерференция
6. bandwidth (n)	ширина полосы пропускания
7. sensor (n)	датчик
8. remote sensing	дистанционное считывание
9. bundle (n)	пучок, группа
10. network k(n, v)	сеть; создавать/подключаться к сети
11. propagate (v)	распространять(ся)
12. attenuation (n)	затухание
13. repeater (n)	ретранслятор
14. duct (n)	канал
15. cross-talk (n)	помехи, перекрестные искажения
16. pick up of smth	улавливание (зд .шума)
17. ignition (n)	воспламенение, возгорание
18. modulate (v)	модулировать, понижать частоту
19. light guide (n)	световод
20. imaging device	устройство изображения
21. gain medium	рабочая среда лазера
22. route (v)	направлять

5.2. Match the words with their definitions.

1. fibre	a. to change something, especially in order to achieve some effect
2. fibre optics	b. a very thin piece of natural or artificial substance
3. sensor	c. the reduction of strength, amount or size of something
4. bundle	d. the use of long fibres of glass or plastic to carry information as light signals
5. immune	e. a piece of equipment that reacts to physical changes such as amount of heat, light, etc.
6. loss	f. a group of things that have been tied or connected together

7. network g. not influenced or affected by something
8. attenuation h. to connect computers together so that each computer can send and receive information
9. modulate i. the state of having less of something than before.

5.3. Read the text and find the answers to the following questions.

1. What is an optical fibre?
2. Where can optical fibres be used?
3. What are the advantages of optical fiber over electrical cables?

OPTICAL FIBER AND ITS USE

A

An optical fiber (or fibre) is a glass or plastic fiber that carries light along its length. Fiber optics belongs to both applied science and engineering and is concerned with the design and application of optical fibers. Optical fibers are widely used in fiber-optic communications, which permits transmission over longer distances and at higher bandwidths than other forms of communications. Fibers are used instead of metal wires because signals travel along them with less loss, and they are also immune to electromagnetic interference. Fibers are also used for illumination. Specially designed fibers are used for a variety of other applications, including sensors and fiber lasers etc.

B

Optical fiber can be used as a medium for telecommunication and networking because it is flexible and can be bundled as cables. It is especially advantageous for long-distance communications, because light propagates through the fiber with little attenuation compared to electrical cables. This allows using few repeaters over long distances. For short distance applications, such as creating a network within an office building, fiber-optic cabling can be used to save space in cable ducts. This is because a single fiber can often carry much more data than many electrical cables. Fiber is also immune to electrical interference. There is no cross-talk between signals in different cables and no pickup of environmental noise. They can also be used in environments where explosive fumes are present, without danger of ignition.

C

Fibers have many uses in remote sensing. In some applications, the sensor is itself an optical fiber. In other cases, fiber is used to connect a non-fiberoptic sensor to a measurement system. Depending on the application, fiber may be used because of its small size, or the fact that no electrical power is needed at remote location. Optical fibers can be used as sensors strain, temperature, pressure and other quantities by modifying a fiber so that the quantity to be measured modulates the intensity, phase, polarization, wavelength or transit time of light in the fiber. Sensors that vary the intensity of light are the simplest, since only a simple source and detector are required. A particularly useful feature of such fiber-optic sensors is that they can, if required, provide distributed sensing over distances of up to one meter.

D

Fibers are widely used in illumination applications. They are used as light guides in medical and other applications where bright light needs to be shone on a target. In some buildings, optical fibers are used to route sunlight from the roof to other parts of the building. Optical fiber illumination is also used for decorative applications, including signs, art, and artificial Christmas trees. Swarovski boutiques use optical fibers to illuminate their crystal showcases(витрины) from many angles while only employing one light source. Optical fiber is an intrinsic (существенный) part of the light-transmitting concrete building product, LiTraCon.

E

Optical fibers can be used in many other applications. For example, in imaging devices called endoscope, which is used to view objects through a small hole. In spectroscopy, optical fiber bundles are used to transmit light from a spectrometer to a substance which cannot be placed inside the spectrometer itself, in order to analyze its composition.

An optical fiber with certain rare-earth (редкоземельный) elements can be used as the gain medium of a laser or optical amplifier. Sometimes it is used to supply a low level of power (around 1 watt) to electronics situated in a difficult electrical environment. Examples of this are electronics in high-power antenna elements and measurement devices used in high voltage transmission equipment.

Thus we see that the application of optical fiber is enormous and, no doubt, it will increase with further development of engineering.

Comprehension

5.4. Read the text again and match the subtitles with the corresponding parts of the text.

1. Fibers in illumination
2. Other uses of optical fibers.
3. Fiber optic sensors.
4. Optical fiber communication.
5. Optical fibers and their advantages over electric cables.

5.5. Find the answers to the following questions in the text.

1. What is an optical fiber? (A)
2. What are the advantages of optical fibers? (A)
3. Due to what positive features are optical fibers used for long- and short-distance communications? (B)
4. What physical quantities (величины) can be measured by optical fibers used as sensors?(C)
5. What principles are these measurements based on? (C)
6. Where can optical fibers be used for illumination? (D)
7. What do you know about other areas of optical fiber applications? (E)

Writing

5.6. Write a short essay on the advantages of using optical fibers (60 – 80 words).

Compiled by Vashtaeva L. I. (Units 3–5), Gamm A. E. (Units 1–3),
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MODULE VIII

Power Engineering Faculty

Unit 1

Vocabulary

1. automation.	автоматизация
2. electric shop	электроцех
3. heat energy	тепловая энергия
4. high voltage	высокое напряжение
5. hydraulics	гидравлика
6. hydroenergy	гидроэнергия
7. industrial enterprise	завод
8. insulation	изолирующий материал
9. occupational safety	техника безопасности
10. Power engineering	энергетика
11. Power plant	электростанция; двигатель
12. Power supply	энергообеспечение

Before you read:

1.1. a) Tell your groupmates about the reasons why you've decided to enter this faculty but not another one.

b) What do you already know about your faculty (history, traditions, the main directions of training, etc.)? Share your ideas with your groupmates.

1.2. Read the text and do the exercises given below.

POWER ENGINEERING FACULTY

Power engineering faculty was set up in 1962. The Faculty offers a multi-level specialist education scheme that provides training at associate, undergraduate, graduate and professional diploma levels.

The first four years of study at the Faculty are spent on earning the Bachelor of Science (B.Sc.) degree in power engineering. The programme required for the Bachelor's degree includes general education in engineering disciplines and a field of specialization usually called a major or core subject. Along with a major there may be a number of related areas of study referred to as minor subjects. Those areas in which students are permitted to select subjects of interest are referred to as elective courses.

Research-oriented students holding the B.Sc. degree may undertake a two-year programme with emphasis on theoretical and applied research leading to the Master of Science (M.Sc.) degree in power engineering. The degree of M.Sc. is awarded to candidates who successfully complete the programme and pass examinations followed by the submission of a project, report or thesis. Another opportunity for professional career-oriented students is a 5.5 – year programme of study culminating in awarding the Diploma in power engineering. Graduates holding the M.Sc. degree or the Diploma in engineering wishing to follow a more scientific career may prefer to undertake a postgraduate programme in the area of specialization.

Many of the teaching and research staff members working at the Faculty are known for their academic and scientific accomplishments. Qualified and competent professors (Doctors of Science), associate professors (Candidates of Science), assistant professors and instructors contribute to the education of students. Research and instruction at the Faculty is supported by well-equipped instructional laboratories at the University and by specialized laboratories at related power engineering institutions. The Faculty computation facilities include computer classes equipped with personal computers having an access to the Internet and printers. The library provides a full range of services, both internally and via the University computer network.

Structure of course

Instruction consists of formal lectures, tutorials, seminars, laboratory work, individual study in libraries and a project. Each student has a supervisor for his/her research project. This project may be carried out within the Faculty, or in close collaboration with industry.

The Power Engineering Faculty offers students the following programmes licensed by the Ministry of Education of the Russian Federation:

1. Power engineering economics and management.
2. Heat power plants.
3. Electric power plants.
4. Electric power systems and networks.

5. Power supply.
6. High voltage electrical and power engineering.
7. Relay protection and automation of electric power systems.
8. Human and occupational safety.

Comprehension

1.3. Put the headings in the logical order

A. Earning the Bachelor of Science degree.
B. The programmes of the Power Engineering Faculty.
C. The academic staff and facilities.
D. General information.
E. After holding the B.Sc. degree.

1.4. Say if the following statements are true or false.

1. Power engineering faculty was set up in 1967.
2. The first five years of study at the Faculty are spent on earning the Bachelor of Science degree.
3. The programme required for Bachelor's degree includes only core subjects.
4. After holding the B. Sc. Degree students can continue their training.
5. To be awarded the Diploma in power engineering one needs 5.5 years.
6. The students do research work on their own.
7. Students can lead their research only in the well-equipped laboratories of the University.
8. The Power Engineering Faculty offers 6 directions for students' training.

Grammar revision

1.6. Make up 6 questions of different types (general, special, alternative and disjunctive) to the text. Ask your groupmates.

1.7. Find as many participles as you can in the fourth passage. Put them down into two columns (Participle I and Participle II). Make word combinations of your own.

Unit 2

Before you read:

2.1. a) Discuss the role of power engineering in modern life.

b) Imagine that you are telling your friend about the management department. What information would you give him?

c) What harm can power engineering do to the Earth and how can engineers protect the environment?

2.2. Read the text to get acquainted with the main historical dates connected with the Power Engineering Faculty.

FROM THE HISTORY OF THE POWER FACULTY

The Power faculty is one of the biggest faculties of NSTU. The training of power engineers began at the electromechanical faculty in 1955 and in 1956 the first department of electric power direction started its work.

In 1959 the department of technique of high voltage began to work. The development of electropower education demanded the creation of new departments and in 1961 the department of safety and electric mounted technology was formed. Then in the same year three more departments were formed: "Electric power plants", "Electric nets and systems" and "Electric power supply of industrial enterprises and cities".

The quantity of full-time and part-time students reached about 700 and it was decided to open the power faculty. The first dean was Professor O. N. Veselovsky. Later, in 1965, the department of hydroenergy and economics was formed. The same year the department of heat energy and hydraulics joined the faculty. So the formation of the faculty was completed. But our industry demanded new specialists and at the end of the 80-s a new department was opened – "Automatic control of power systems". In those years the reformation of higher education began, and there was a need in new specialists and that was why the faculty began to train specialists for heat power plants. Later students were enrolled to the new speciality "Power engineering economics and management".

In 1993 Yu. M. Sidorkin was elected as the dean of the power faculty. He did a lot for the development of the faculty. In 1998 there appeared new specialities: "Human and occupational safety" and "Relay protection and automation of electric power systems".

Now it is the biggest faculty of NSTU, there are more than 2200 students. 1600 are full-time students and 600 – part-time ones. The academic staff is about 100 teachers. There are two councils – electric power and heat power. And there are a lot of perspectives in the future.

Comprehension

2.3. Find different dates in the text and explain what they are connected with.

2.4. Give Russian equivalents to the following word combinations:

Electropower education, department of hydroenergy and economics, electric power supply of industrial enterprises and cities, high voltage, full-time and part-time students, the reformation of higher education, to be enrolled to the new specialty, the academic staff.

2.5. Find the missing parts of the sentences in the text:

1. …was elected as the dean of the power faculty.
2. The development of electropower education demanded the creation of new departments and in 1961 … .
3. In those years the reformation of higher education began …. for heat power plants.
4. The first dean was… .
5. In 1998 …
6. … "Automatic control of power systems".
7. In 1959 … .

2.6. Put these events according to the chronological order provided in the text:

a. The election of Yu. M. Sidorkin as the dean
b. The formation of the department of hydroenergy and economics.
c. The beginning of the training of power engineers at the electromechanical faculty.
d. The formation of the department of safety and electric mounted technology.
e. The introduction of new specialties "Human and occupational safety" and "Relay protection and automation of electric power systems".
f. The opening of the department "Automatic control of power systems".

2.7. Match up the parts of the sentences.

1. Electric engineers
2. Solar power

3. A lot of subjects
4. Bachelor's Degree
5. Enterprising and competent specialists
6. Students ' abilities for organization
7. Great attention is paid to
8. High voltage equipment

a) are developed.
b) students who do research work.
c) is used as an alternative source of power.
d) are studied by future engineers.
e) is received after four years of training.
f) are trained at Power Faculty.
g) are required everywhere in industry.
h) is widely used in electric industry.

Grammar revision:

2.8. Choose ten verbs from the text 2.2. Make up 10 sentences using these verbs in the Complex Object.

2.9. Use the following word combinations to make up sentences with Complex Subject:
The Power faculty; electropower education; electronic mounted energy; hydraulics; power systems; relay protection; electric nets; hydroenergy; industrial enterprise; high voltage.

Speaking

2.10. Make a presentation on the topic "Power Engineering Faculty" using the information from the texts above.

Unit 3

Before you read

3.1. Give the Russian equivalents to the English names of specialities provided by the Faculty of Power Engineering

1. Power engineering economics and management.
2. Heat power plants.

3. Electric power plants.
4. Electric power systems and networks.
5. Power supply.
6. High voltage electrical and power engineering.
7. Relay protection and automation of electric power systems.
8. Human and occupational safety.

3.2. Remember the time when you were a school leaver. Tell your groupmates why you have chosen the department you are studying at but not another one.

3.3. Read the text and do the exercises given below.

INTRODUCTION TO SPECIALITY. FACULTY OF POWER ENGINEERING

Power engineering is the basis for the whole national economy and it determines the level and rate of its development. Highly qualified electrical engineers are trained in several specialities at the departments of power engineering. There is also an individual training dealing with research, elaboration, design and operation of automatic and automated high-voltage installations and devices used in power and electrical engineering, electrophysics, power installations of thermal stations; it also deals with management problems.

The term of instructions at the Power Engineering Faculty is four years to receive Bachelor's Degree, after five years and a half students become professionally qualified engineers and after six years of training they can receive Master's Degree.

Management department

Power industry is the most stable, reliable and attractive for innovative management and business activities in all countries of the world. The development of power engineering, the improvement of administrative systems and world integrity require enterprising, competent and businesslike managers having all modern scientific knowledge in management and able to take in account all the changes in industry and society. The curriculum provides advanced knowledge and comprehensive information on the problems of management, marketing, computerization, and banking. The students also acquire knowledge and skills in sociology and psychology of administrative activity, their abilities for organization are developed as well.

Thermal stations department

Power balance of the country depends to large extent on thermal stations operation. The speciality trains experts in operation, design, construction and adjustment of thermal stations power equipment. Nowadays the problem of production is of primary importance, it refers to electric power generation. Great attention is paid to training of students, capable to do research in this field, to work out new environmentally friendly technologies for power stations to be built in future. There are interesting tasks, for those, who like to solder complicated semiconductor circuits, to solve tasks, connected with programming, and for those, who are inclined to theoretical research based upon modern mathematical theories. As all branches of national economy consume electric power, the graduates of this speciality can work at different places, ranging from industrial enterprises to large ocean ships.

Technique and electrophysics of high voltage department

There is an acute need for specialists in high voltage technique in modern power systems, as millions of volts are used for generation, transmission and distribution of electric power. High-voltage equipment is the basis of modern electric installations. Neither automatics nor electronics can ensure power system reliable operation without equipment. Students of this speciality study mathematics, physics, electronics and computer technology. Such training gives them an opportunity to specialize not only in the field of high-voltage equipment, but also in the field of electrophysical equipment: lasers, accelerators, electric ionizers, etc. Graduates of this speciality work at: **power station electric shops; insulation service; high voltage equipment service; high-voltage lines service; reliability and accident prevention services; communication services; the largest substations.**

Electric systems automatic control department

Electric power is characterized by extremely quick process development in electric circuits and it is possible to store it for a long time, e.g. in case of some breakdown at a power station. Electric power must be generated at the moment it is consumed. Such complicated tasks can be solved only with the help of modern means of automation and telecontrol, based on microelectronics and computer technology.

Engineers of this speciality elaborate and improve means of automation and algorithms for its functioning; they provide optimum operation of automatic control systems of power plants, substations and electric power systems. The graduates have thorough knowledge of physics, mathematics, electronics, relay defense and other subjects which ensure a wide profile of their education. They also can conduct some actual research work.

What is Electrical Energy System Engineering?

• Electrical Energy Systems Engineering (EESE) is a branch of Electrical Engineering which deals with all aspects of supply, control and use of electrical energy.

• Energy is vital to modern life: for powering industry and transport; providing heating and lighting; and operating the domestic, recreational, healthcare, business and personal items of equipment on which we have come to rely.

• Electrical energy is one of the most important forms of energy because it can be:

– Derived (converted) from other energy forms such as heat, light, chemical energy, mechanical work, nuclear energy.

– Easily derived in large or small amounts

– Controlled

– Clean, quite and safe when used correctly.

The need for electrical energy continues to increase as it replaces other forms for space heating, industrial processes and road\rail\sea transport. It is vital that this energy is made available at the minimum cost to our planet's resources and the environment. The challenge for engineers is to supply the energy and save the planet.

Comprehension:

3.4. Find the English equivalents from the text tot he words and the word combinations given below:

Электроэнергетика; энергетическая промышленность; энергетический баланс государства; острая потребность в специалистах по технике высоких напряжений; высоковольтное оборудование; электрическая мощность; современные средства автоматизации и телеконтроля; предоставление тепла и света; потребность в электроэнергии; снабжать электроэнергией.

3.5. Expand on the following:

1. Power engineering is the basis for the whole national economy.
2. There is an acute need for specialists in high voltage technique.
3. It is important to train specialists in operation, design, construction and adjustment of thermal stations power equipment.
4. Engineers graduating from the Electric systems automatic control department are very highly-qualified specialists.
5. The challenge for engineers is to supply the energy and save the planet.

Grammar revision

3.6. Look through the text above and find sentences with the verbs in the Passive Voice.

3.7. Open the brackets and put the verb in the Passive Voice.

1. Electric power (to generate) by several types of power stations.
2. Complicated tasks (to solve) by students who do research work.
3. Modern means of automation and telecontrol (to base) on microelectronics and computer technology.
4. High-voltage devices (to use) in power and electrical engineering.
5. Master's Degree (to receive) after six years of training.
6. Systems of telecontrol (to develop) successfully.
7. Necessary knowledge and skills (to acquire) at the Faculty of Power Engineering.

Speaking

3.8. Work in pairs. Make up dialogues on the topic "The Future of Power Engineering Faculty Graduates".

Unit 4

Before you read

4.1. Discuss with your partner exhaustible energy sources. Answer the question: "For how long will they be able to exist?"

4.2. Read the text and answer two questions asked in it.

RENEWABLE ENERGY.
By Kent S. Markle.

When you plug an electrical appliance into the wall socket, do you know where your electricity comes from? Probably the local public utility company. But how does the utility company generate the electricity you use at home? If it is like most power companies, it produced electrical power by burning fossil fuels – coal, natural gas, or oil – to make steam, which turns turbines to generate electricity at the power plant. To take one example of dependence on these three types of fossil fuel, in the United States in 2004,

88 percent of all the electricity generated came from coal, natural gas, and oil. They are non-renewable fuels, originating from organic matter of the late Paleozoic Era (several hundred million years ago) and estimated by most scientists to run out during this century. **When coal, natural gas, and oil supplies are depleted, how will people see to read at night? What will power their computers and factories?** Fortunately, there are renewable, alternative sources of energy for electrcity and transportation that have well-developed technology.

Some renewable energy sources are well known and already in wide use. For example, hydroelectric power is generated by water in dams. In the U.S., hydroelectric power provides 10 percent of all electricity. Other alternative sources of energy are not well known to the public or are still in the development stages. The World Energy Council has identified six sources of energy to pursue as alternatives to non-renewable fossil fuels:

Solar (energy from the sun)

Wind (energy from moving air)

Geothermal (energy from heat inside the earth)

Modern biomass (energy from plant and animal residues)

Ocean (energy from seawater movement and temperature changes)

Small hydroelectric (energy from small dams, such as those filled by melting snow)

It is worth pointing out why large hydroelectric (large dams that block rivers) and traditional biomass (firewood and charcoal) were excluded from the Council's focus. These two renewable sources of energy often cause environmental problems and other adverse effects. Large hydroelectric projects usually require long planning and construction, which delays their benifit, and sometimes results in social problems, such as displacement of people living near rivers that are dammed. Traditional biomass (burning trees) results in air pollution and deforestation. A combination of these six other alternative sources of energy may prove to be our best hope to fill the energy void created as supplies of fossil fuels gradually diminish.

Speaking

4.3. Enumerate renewable energy sources. Dwell upon the ones which, in your opinion, are the most perspective in our country. Prove your ideas.

Unit 5

5.1. Read and summarise the text using the tips given below.

HISTORY

Since the early days of Industrial Age, industries and utility companies have relied on a variety of different sources of power. The Danes were pioneers in wind-generated electricity, building over 100 systems (called "wind mills") in 1890 to capture the North Sea winds. Coal was the fuel of choice for steam-powered engines, which were widely used in manufacturing and transportation. In fact, in the 1890s, more electric- and steam powered cars were sold than those using gasoline.

The world's first geothermal electric plant was built in Italy in 1904. Surprisingly, photovoltaic (solar) cells were built as early as the 1880s, but it wasn't until Bell Labs developed silicon cells in 1954 that solar cells could be used efficiently. In 1958, the Vanguard satellite was equipped with solar photovoltaic cells.

The world's first power plant using the ocean's tides was built in France in 1966.

The global energy situation began to change significantly in the second half of the century. For example, in the U.S. from 1950 to 1995, coal virtually disappeared as a heating source for homes. By 1995, natural gas was used for heat in over 50 % of U.S. homes, and electricity was used in 27% of them. In about the same time frame, per capita electricity consumption rose by over 1,000 %. Widespread ownership of energy-hungry appliances such as air conditioners, refrigerators, and clothes dryers contributed to this huge growth in energy consumption, while individual automobile ownership created a heavy demand for new petroleum supplies. By 1958, the U.S. had begun to consume more fuel of various kinds than it was produced. Oil prices per barrel rose from about $5 in the 1960s to over $17 in October 1973, and further production limitations caused the price to rise to about $34 in 1981.

By the mid-1980s, geologists and other scientists began to make predictions about how long the world's petroleum supplies would last. By estimating future rates of oil consumption, then taking into account the amount of petroleum reserves, they calculated that supplies could last between 50 and 100 years longer.

Nuclear power, which had once been the energy hope of the future, no longer seemed so attractive after accidents at Three Mile Island in the U.S. in 1979 and Chernobyl in the former Soviet Union in 1986 changed the public's perception of its safety. France has continued to operate nuclear plants for 75% of its electricity, with a good safety record, however, other countries have scaled back plans for building nuclear generating facilities, and the disposal of spent radioactive fuel remains a problem.

HOW TO WRITE A SUMMARY

1. Read the passage for overall content.
2. Reread carefully, highlighting the main idea and any key supporting ideas.
3. Group the reading into sections according to the author's topic divisions and label them.
4. Write a one-sentence summary of each section, focusing on the main point. Do not include examples or minor details.
5. Write one sentence (the thesis) that summarizes the whole article.
6. Write the first draft: In the first sentence include the title and the author of the text.
7. Then use your one-sentence summaries to complete the summary. Do not include your own opinion, but *be sure to use your own words*.
8. In your final draft, insert transitional words and phrases where necessary. Avoid short sentences. Combine sentences for a smooth, logical flow of ideas.

Other useful information:

- Use 3rd person and present tense.
- Be concise and brief.
- Periodically indicate that the summary is still the material of the author.
- Quote the author sparingly, if at all.
- Check for grammar, punctuation, and spelling mistakes.

TRANSITIONAL WORDS FOR SUMMARY

A. Introductory remarks.

It is generally agreed today that...In approaching this issue, one should...Nowadays, it is scarcely possible to...The business world offers us numerous examples of...

B. Ordering elements

Firstly,.../ Secondly,.../ Finally,... (note the comma after all these introductory words.)

If on the one hand it can be said that... the same is not true for...The first argument suggests that... whilst the second suggests that...

C. Adding elements

Furthermore, one should not forget that...In addition to...Moreover...

D. Accepting other points of view

Nevertheless, one should accept that...However, we also agree that...

E. Personal opinion

We personally believe that...Our own point of view is that...

F. Others' opinions

Experts...
... believe that
... say that
... suggest that
... are convinced that
... point out that
... emphasise that
According to some experts...

G. Introducing examples

Take for example...To illustrate this point one needs only refer to...

H. Certainty

Doubtless,...One cannot deny that...It is (very) clear from these observations that...

I. Doubt

All the same, it is possible that...It is difficult to believe that...

J. Moderating, agreeing, disagreeing

By and large...Perhaps we should also point out the fact that...It would be unfair not to mention that fact that...One must admit that...We cannot ignore the fact that...One cannot possibly accept the fact that...

K. Conclusion

The arguments we have presented... suggest that.../ prove that.../ would indicate that...From these arguments one must.../ could.../ might... conclude that...All of this points to the conclusion that...

Sample Summary

Bergman and Partner is developing and optimizing different technologies for electricity generation since the early eighties. The paper describes in a short form the principle function of such systems and the field of application of each system. This is followed by a presentation of the correspondent developments of the company with a comprehensive description of current work and the state of the art (современный) technologies. Finally the paper goes into details of upcomming realization of prototypes, pilot plants and commercial plants.

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И СПЕЦИАЛЬНОСТИ

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