МИНИСТЕРСТВО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
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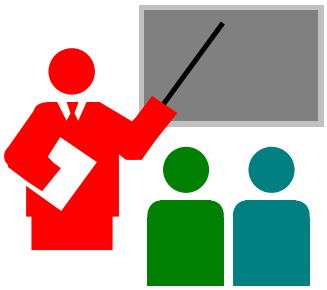
АНГЛИЙСКИЙ ЯЗЫК ДЛЯ СТУДЕНТОВ МАШИНОСТРОИТЕЛЬНЫХ СПЕЦИАЛЬНОСТЕЙ



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Предисловие.

Методическое пособие «Английский язык для студентов машиностроительных специальностей» предназначен для студентов, обучающихся по специальности 120100.

Пособие состоит из 5 разделов, каждый из которых содержит тексты, задания к ним, а также ряд упражнений на тренировку грамматики современного английского языка.

Объем и содержание лексического и грамматического материала определены программой по английскому языку для неязыковых вузов и соответствуют реально существующим направлениям подготовки специалистов машиностроительного профиля.

UNIT I. HIGHER EDUCATION

Text 1. HIGHER EDUCATION IN GREAT BRITAIN

Задание 1. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

academic – учебный;
tutorial – консультация;
particular feature – отличительная черта;
strong links – прочные связи;
Bachelor of Arts – бакалавр искусств;
Master of Arts – магистр искусств;
science – наука

Задание 2. Прочитайте и переведите текст.

There are some 90 universities and 70 other higher education institutions in Great Britain: polytechnics and numerous colleges for more specialized needs, such as colleges of technology, technical colleges, colleges of arts and agricultural colleges in England and Wales. They all provide a wide range of courses from lower-level technical and commercial courses through specialized courses of various kinds to advanced courses for those who want to get higher-level posts in commerce, industry and administration, or take up one of a variety of professions.

Courses are a combination of lectures, seminars, tutorials and laboratory work. In a lecture the student is one of a large number of students. He listens to the lecturers, takes notes, but asks no questions. In a seminar he raises problems and discusses them with his fellow students under the direction of one of the teachers. In a tutorial he is accompanied by only a handful of students and discusses his personal academic problems with a teacher.

Study in courses may be full-time and part-time. Full-time education includes sandwich courses in which periods of full-time study (for example, six months) alternate with full-time practical work and training in industry. Full-time and sandwich courses now are an important part of higher education in England and Wales.

A degree is an academic qualification awarded at most universities and colleges upon completion of a higher educational course (a first degree) or piece of research (higher degrees). If students pass their final exam at the end of a three-year course, they get their first degree. Students with a first degree become Bachelors of Arts or Science, and can put B.A. or B.Sc. after their names. If they want to go a step further and become Master of Arts or science, they have to write an original paper, or thesis, on some subject based on a short period of research, usually soon after graduation. If students wish to become academics and perhaps teach in a university; then they will work for a higher degree, a Doctor of Philosophy – a Ph.D. For this they will have to carry out some important research work.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Прочитайте следующие предложения и назовите значения выделенных слов.

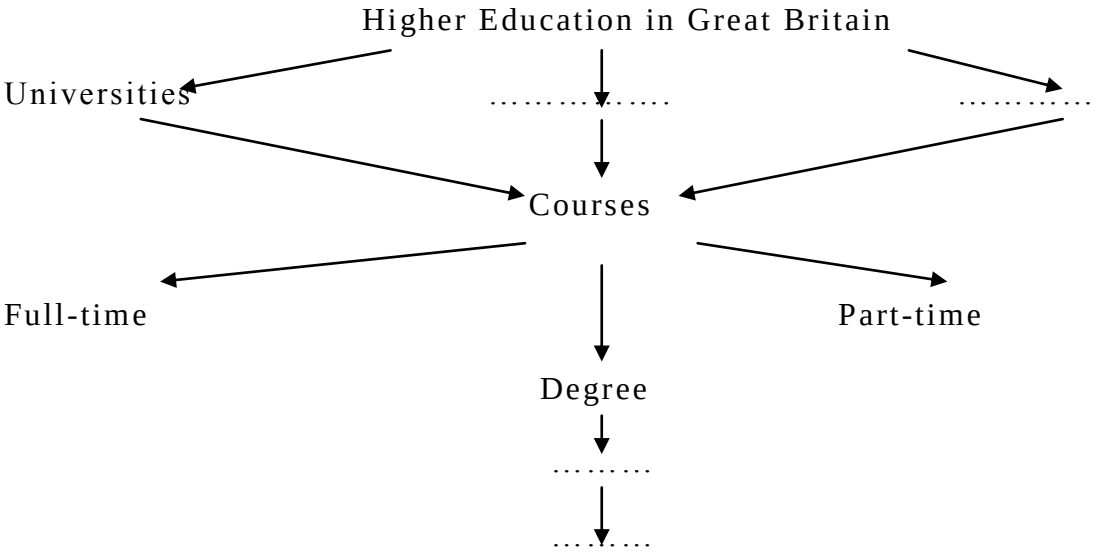
1. ***Colleges*** are technical or professional schools which prepare students for specific job or offer a specialist qualification. 2. ***Technical college*** is a college, specializing in technical subjects. 3. ***College of technology*** also specializes in technical subjects but provides more advanced courses than a traditional technical college. 4. ***Polytechnics*** are centres for advanced courses in a wide range of subjects. 5. ***A course*** is a complete period of studies. 6. ***Sandwich courses*** are courses in which students alternate studies with practical work in industry.

II. Ответьте на вопросы по теме "Higher Education In Great Britain".

1. How many higher educational institutions are there in Great Britain? What are they? 2. What kind of training do they provide? 3. What does a student do at the lectures? in a tutorial? 4. What did you learn about different forms of education at British universities? 5. What is a degree? 6.When do students get Bachelor's degree? Master's degree? 7.What will students do to become academics?

III. На основании полученной из текста информации дополните таблицу и логическую схему:

First degree		On completion of a three-year course
Higher degrees		
	Doctor of Philosophy	



IV. Расскажите о системе высшего образования в Великобритании, воспользовавшись составленной вами схемой.

GRAMMAR REVISION
THE NOUN

Множественное число (N+-s)	Исключения
1. a) [s] desks, subjects, cats b) [z] boys, dogs c) [iz]gases, brushes, pages 2. **Изменения в написании**: a) boy-boys; study-studies b) hero-heroes (но: kilo-kilos) c)shelf-shelves; knife-knives; wife-wives; life-lives (but: chief-chiefs; handkerchief-handkerchiefs; roof-roofs; safe-safes) 3. **Только в единственном числе**: a) mathematics, physics, phonetics b) news, advice c) water, love, sugar, information d) money, hair e) fruit, fish (еда) 4. **Только во множ. числе**: a) scissors, trousers, spectacles b) goods, clothes, riches c) wages, contents d) people – люди (но: peoples - народы) e) youth – молодежь (но:youths-юноши)	1) man-men; woman-women; foot-feet; tooth-teeth; goose-geese; mouse-mice 2) ox-oxen; child-children 3) datum–data; formula-formulae; phenomenon-phenomena; basis-bases; crisis-crises; thesis-theses; nucleus-nuclei 4) penny – pence (or pennies) 5)sheep-sheep; deer-deer; swine-swine; aircraft-aircraft; series-series; species-species

I. Найдите в тексте существительные во множественном числе и прочитайте их. Объясните способ образования множественного числа.

II. Измените число у следующих существительных, если это возможно.

clock, page, mouse, table, chief, datum, news, fish, youth, key, goods, son, child, wife, cargo, passer-by, sheep, riches, watch, people, forget-me-not, university, information

III. Раскройте скобки, поставив глагол в нужной форме.

1. Mathematics (to be) too difficult for understanding. 2. Your advice (to be) very good for me. 3. The money which were spent on books (to be) mine. 4. Last year my knowledge of English (to be) minimal. 5. The police (to be) always arriving at the place of an accident in time. 6. Phonetics (to be) a branch of linguistics. 7. Fruit (to be) very expensive in winter. 8. What time (to be) the news on TV? 10.There (to be) their clock on the wall. 11. Your news (to be) very strange. 12. Her hair (to be) very greasy. 13. The deer (to be) ravaging Mr White's fields. 14. There (to be) some fish on the plate.

15. Your advice (to be) very silly. 16. The youth (to be) the main theme of discussion at the conference yesterday. 17. Where (to be) my scissors? 18. The biggest research centre in Russia (to be) the Russian Academy of Sciences. 19. Every student (to be) interested in this problem last year. 20. They (to be) at the plant tomorrow. 21. You (to be) in the chemical laboratory a week ago? – No, we (not to be). We (to be) there only the day after tomorrow.

PRONOUNS

Личные местоимения		Притяжательные местоимения		Возвратные местоимения	Указательные местоимения
Именит. падеж	Объект. падеж	Зависимая форма	Независ ис. форма		
I – я	me – меня, мне	my – мой, моя	mine	myself – сам, сама	this – этот, эта, это (ед.ч.) these - эти
we - мы	us – нас, нам	our – наш, наша	ours	ourselves – сами	that – тот, та, то (ед.ч.) those – те
you – ты, вы	you – тебя, тебе вас, вам	your – твой, твоя, твое, твои, ваш, ваша…	yours	yourself – сам, сама, само yourselves - сами	the same – тот же самый, один и тот же such (a) – такой, такая, такое, такие
he –он	him – его, ему	his – его	his	himself – сам	
she – она	her – ей, ее	her – ее	hers	herself – сама	
it – оно	it – его, ее	its – его, ее	its	itself – сам, сама, само	
they – они	them – их	their – их	theirs	themselves - сами	

IV. Замените выделенные слова местоимениями.

1. ***The school year*** runs from September till July. 2. For Oxford and Cambridge ***school leavers*** have to take special exams. 3. ***The exercise*** is easy. ***Jane*** can do it without your help. 4. ***Jane and Kate*** are at the institute. .. is always there at this time. 5. Where is ***my cat***? 6. Have you got a friend? Yes, I've got a boy-friend. I used to spend weekends with ***my boy-friend***. 7. What do you know about England's climate? – I know that ***its climate*** is mild and damp. 8. ***England*** is washed by the North sea, the Irish Sea the English Channel and the Strait of Dover. 9. ***Full-time and sandwich courses*** are an important part of higher education in England and Wales.

V. Закончите предложения, используя фразы *on my own/by myself* etc.

1. Did you go on holiday on ...? 2. I'm glad I live with other people. I wouldn't like to live on ...3.The box was too heavy for me to lift by... 4. 'Who was Tom with when you saw him?' 'Nobody. He was by ... ' 5. Very young children should not go swimming by ... 6. I don't think she knows many people. When I see her, she is always by ... 7. I don't like strawberries with cream. I like them on ... 8. Do you like working with other people or do you prefer working by...?

VI. Измените предложения, используя структуру *'a friend of mine'*:

1. I am writing to one of my friends. 2. We met one of your relations. 3. Henry borrowed one of my books. 4. Ann invited some of her friends to her flat. 5. We had dinner with one of our neighbours. 6. I went on holiday with two of my friends. 7. Is that man one of your friends? 8. I met one of Jane's friends at the party.

VII. Вставьте вместо пропусков *some, any, no, every* или их производные:

1. Here are ... books by English writers. Take ... book you like. 2. There are ... boys in the garden because they are at the cinema. 3. I can see... on the snow, but I don't know what it is. 4. There are ... students in the hall, but there are ... lecturers. 5. Did he say ... about it? – No, he said ... . 6. There was ... in the street because it was very late. 7. ... wants to see him. 8. Is there ... here who knows this man? 9. Have you got... books on Dickens? I want to read ... about him. I have read ... books by Dickens and I am interested in the life of the writer. 10. Please bring me ... apples, Mary. 11. That is a very easy question. ... can answer it. 12. I put my dictionary ... yesterday and now I can't find it ... . – Of course, that is because you leave your books ... . 13. Did you go ... on Sunday? 14. ... student should know this rule. 15. How could I know that he was ill? ... told me about it.

Text 2. BRITISH UNIVERSITIES.

Задание. Прочитайте и переведите текст.

There is no single, universally accepted definition of what a university should be like. British universities are different. In 1960 there were only 23 British universities. Today there are 90. They can be roughly divided into the following groups:

Oxford and Cambridge. Scholars were studying in these ancient universities in the early thirteenth century. Since that time Oxford and Cambridge have continued to grow, but until the nineteenth century they were the only universities in England, and they offered no place to girls. Oxford and Cambridge are the two oldest and most prestigious universities in Britain. They are often called collectively Oxbridge. Many Oxbridge students come from public schools, and Oxbridge graduates often go on to become influential and powerful in British society.

Oxford and Cambridge universities consist of a number of colleges. Each college has its name and coat of arms, its own character and

individuality. The universities have over a hundred societies and clubs: dramatic societies, language clubs, philosophy societies, debating clubs, political clubs of all colours. Important part of the students' life is sports, the most popular sports are rowing and punting.

All the students wear their traditional black gowns. The majority of the students are the sons of rich parents, as the tuition fee at Oxbridge is very high, between 2 and 3 hundred pounds a term. The universities organizes lectures, arranges examinations, gives degrees and so on. Each college of the universities has its own character and individuality. But every college has its arts students and science men, its medical students and its engineers. Every student follows his own course of study. He has a tutor who helps him to study and observes his work. As a rule, those who once finished Oxbridge send their sons and grandsons to study there, they live in the same colleges where their fathers and grandfathers lived, and they are the members of the same club. Both universities are independent from the state

Four Universities were founded in Scotland before Scotland and England were united: St. Andrews (1411), Glasgow (1450), Aberdeen (1494) and Edinburgh (1583).

The Redbrick Universities. In this group are listed all universities founded between 1850 and 1930 including London University. They were called “redbrick”, because that was the favourite building material of the time, but they are rarely referred to as “Redbrick” today.

The New Universities. These were all founded after the Second World War. Some of them quickly became popular because of their modern approach to university courses. In 1992 the majority of British polytechnics, that offered a wide range of subjects and many had close links with industry and commerce in their local area, were also incorporated into universities. So at present there are four different types of universities in Great Britain.

The typical academic program for university students in Great Britain is composed of a varying number of subjects within a field of specialization. The academic activities for each subject fall into three types: lectures at which attendance is not always compulsory, tutorials and examinations. These three categories provide the means by which students prepare themselves in specialized fields of knowledge. However, universities have never had a monopoly on higher learning. In Britain, full-time higher education also takes place outside the universities.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Переведите следующие слова. Значения выделенных слов («ложных друзей переводчика») уточните по словарю.

universal, **divide**, group, **modern**, material, popular, **local, incorporate,** typical, specialization, monopoly, **activity,** commerce,

II. Завершите предложения, выбрав соответствующие окончания в правом столбце.

1. In 1960 there were …	a) the only universities until the 19th century.
2. Today there are …	b) ninety universities.
3. At present there are …	

4. Oxford and Cambridge were …
5. Four universities were founded …
6. The redbrick universities were founded …
7. The new universities appeared …
8. In 1992 the majority of polytechnics were incorporated …

c) in Scotland in the 15th and 16th centuries.
d) four different types of universities.
e) only twenty-three British universities.
f) after the second World War.
g) into universities.
h) between 1850 and 1930.

III. Дополните следующую таблицу данными из текста.

Type of University	Time	Characteristics
Oxford and Cambridge		
Redbrick Universities		built from red brick
The New Universities		
Universities based on Polytechnics		

IV. Пользуясь информацией текста и приведенной выше таблицей, расскажите об университетах Великобритании.

GRAMMAR REVISION

I. Прочитайте следующие числительные.

125; 605 ; 420; 432,612; 1,056,073; 13,604,270; 1,002; 422; 385; 3,767,546

II. Прочитайте следующие сочетания с числительными. Обратите внимание на разницу образования порядковых и количественных числительных.

2,000 students; 6,935 books; 101 engineers; 16 per cent; 200 branches; 4,005 tables; 785,344 grams; on the 12th day; the 2nd week; on the 3rd of May

III. Прочитайте следующие хронологические даты.

1987; 1900; 2000; 2003; 1876; 1411; 1450; 1830; 1950; 1992; 1583; 1960; 1812; 1432; 1999; 1990

IV. Перевод глагола *to have* зависит от контекста.
have + N – иметь (полнозначный глагол)
have + Ved – не переводится (вспомогательный глагол)
have + toV – должен (эквивалент модального глагола)

a) Найдите в тексте предложения с глаголом *to have* и определите, в каком из вышеперечисленных значений он употреблен.

b) Определите функцию глагола *to have* в следующих предложениях.

1. In walking machine designs, the designers have tried to reproduce the trajectory of man's foot. They have proposed a number of patterns for effecting such trajectories. Some of them have simply resorted to a

rectilinear pattern, while others have selected the optimum trajectory. For example, American scientist J.Shighey has developed a series of mechanisms for walking devices, in particular, a pantograph mechanism.

2. Specialists in engineering materials have taken a new approach to the problem of the permanent nature of materials properties. It is no less useful to have materials whose properties can be changed and controlled. That's why specialists have to create materials with variable porosity, elasticity and thermal conductivity.

V. Измените предложения, используя модель *there is/are* +N+prepN

Model: This institute has two faculties.
– There are two faculties at the institute.

1. The higher technical school in Kursk has a daytime and an evening departments. 2. The higher school has three faculties. 3. We have many laboratories at the Institute. 4. Our country has many branches of industry. 5. This country has a great number of specialists in this field.

VI. Составьте предложения с оборотом *there+be* в нужном времени, пользуясь следующими словами. Переведите их на русский язык.

1. twenty-three, universities, in 1960, were, there, British. 2. 90 universities, are, in, there, the United Kingdom. 3. Scotland, are, in, universities, eight, there. 4. Northern Ireland, two, there, universities, are. 5. system, education, the, is, United States, there, no, national, of, in. 6. nineteen, in there, universities, are, Canada. 7. are, private, there, four, Canada, in universities.

Степени сравнения прилагательных и наречий.

I. **Positive Degree**: high; late; big; busy; active; interesting; bravely, early
II. **Comparative Degree**: higher; later; bigger; busier; more(less) active; more (less) interesting; more (less) bravely, earlier
III. **Superlative Degree**: highest; latest; biggest; busiest; most (least) active; most (least) interesting; most (least) bravely, earliest

Исключения:
Good (well) – better – best; bad (badly)– worse – worst;
little – less – least; much (many) – more – most;
far – farther(further) – farthest (furthest)

Примечание: 1) **old** – older (elder) – the oldest (the eldest)
2) **late** – later (latter) – the latest (the last)
3) **near** – nearer (nearer) – the nearest (the next)

VII. Сравните по следующему образцу.

Model: Steel is ***expensive.***
Silver is ***more expensive***.
Gold is ***the most expensive.***

1. три вещества с точки зрения их значения в промышленности: water, coal, gas (***important)*** 2. три металла с точки зрения их твердости: steel, copper,

aluminium (***hard)*** 3. Три марки автомобилей с точки зрения их веса: “MAZ”, “Zaporozhets”, “Moskvitch” ***(light)***. 4. три вида транспорта с точки зрения скорости: a car, a train, a plane ***(fast)***.

VIII. Заполните таблицу по образцу.

a) small old broad high large great near easy hot thin late	smaller	the smallest
b) difficult specific modern practical effective traditional typical	more difficult	the most difficult

Text 3. THE OPEN UNIVERSITY

Задание 1. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

tuition – обучение;
degree – звание, ученая степень;
paper – письменная работа;
to cover a wide range of – охватывать большой ряд;
manufacturing techniques – методы производства;
by post- по почте;
from all walks of life – разного общественнного положения;
credit system – система зачетов

Задание 2. Прочитайте и переведите текст.

The Open University was established in Britain in 1969 to enable people to study for a best degree at home. It was set up for those people who missed the chance of going to an ordinary university. The University differs from other universities in that its students work in full-time jobs and can study only in their free time by means of distance teaching materials, correspondence and broadcasting.

The Open University started its first course in 1971 with 19,500 students. Now it is Britain’s largest teaching institution, with more than 100,000 men and women taking its various courses at any given time. About

6,000 students of all ages get degrees every year. Its degrees, diplomas and other qualifications are equal to those of any other university.

Apart from the well-known degree courses there are a lot of other courses, some lasting only a few weeks, others ten or twelve months. Courses cover a wide range of subjects – from everyday topics through traditional university disciplines – history, chemistry, electronics and so on – to the latest manufacturing techniques.

The University is open to any person over 18 living in Britain or another member nation of the European Union, regardless of previous education. And of course, you must have the desire to learn.

The OU operates by sending its educational materials to students, in their own homes or places of work. Instruction often makes use of such course materials as special equipment to conduct science and technology experiments at home, audio and videocassettes, and computer software. Students of the OU receive their lessons and lectures in their homes by means of special TV and radio programmes. Some courses are taught via the Internet, while others make use of the Internet as one component of instruction. Some courses include a one-week instruction in residential schools, usually offered during the summer.

The University offers programmes in the arts, mathematics and computing, science and technology, social science, education, health and social welfare, business and humanities.

Students may be of all ages and come from all walks of life. Some of them want to improve their qualification, others come to the university to do something they have always wanted but had no time or good chance to do it before.

The B.A. degree is built up on the credit system. Student's final mark is based on the exam in October and the written assignments done during the year. If you pass and most people do, you have got one credit towards the six that you need for the B.A. degree. At the usual speed of a course a year it will take you six(or eight) years to get your degree.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Найдите в тексте предложения, подтверждающие следующие утверждения.

1. The Open University (OU) offers a wide range of courses at many different levels.
2. The OU was established to give educational opportunities to those people who want to continue their education at home.
3. In its teaching the OU employs a combination of television, radio, computer, correspondence tests, broadcasts and personal tuition.
4. The University is open to everybody.

II. Вы прочитали об одном из университетов Англии. Иногда его называют "University on the Air". Как вы думаете, почему?

GRAMMAR REVISION

I. Заполните пропуски предложенным в скобках словом (school etc.). Если нужно используйте определенный артикль the.

1 (school) a) Every term parents are invited to …… to meet the teachers.
b) Why aren't your children at …… today? Are they ill?
c) When he was younger, Ted hated ……
d) What time does …… start in the mornings in your country?
e) A: How do your children get home from ……? By bus?
B: No, they walk. …… isn't very far.
f) What sort of job does Jenny want to do when she leaves ……?
g) There were some people waiting outside …… to meet their children.
2 (university) a) In your country, do many people go to ……?
b) If you want to get a degree, you normally have to study at……
c) This is only a small town but…… is the biggest in the country.

II. Дополните правую колонку соответствующими наречиями.

Прилагательные	Наречия
technical analytical practical mechanical fundamental electrical theoretical	

Категория времени. (The Category of Tense)

Present Tense

I, we, they, you … work He, she, it … works ***usually, always, often, never, as a rule, seldom, every month (year, week)***	Do you (we, I, they) work? – Yes, you (we, I, they) do. No, I don't Does he (she, it) work? – Yes, he does. No, he does not.

Past Tense

I, he, we … worked She, you lived they, it played experimented came ***yesterday, the day before yesterday, last week (year, month),six months ago, in 1990***	Did I (he, they)work? – Yes, I did. No, I didn't.

Future Tense

I, we shall (will) work You, they, he, she, it will work ***tomorrow, the day after tomorrow, soon, next month (year, week), in a day (month, year)***	Shall (Will) I, we work? – Yes, I shall (will). No, I shan't (won't). Will she (they, he, you, it) work? – Yes, she will. No, she won't.

III. Закончите предложения, выбрав соответствующий показатель времени. (*in the past, in the near future, last year, next year, now, last month, in five years, every year*)

1. Electric cars will help to provide traffic safety … 2. The laboratory supplied the new calculations for designing the engine… 3. The plant produces a great number of machines … 4. She will become an engineer … 5. They finished school … 6. We worked at this plant … 7. My friend works at the research institute… 8. Several scientists work at this problem …

IV. Раскройте скобки, поставив глагол в нужной форме.

1. Prof. Smith (to give) a lecture on physics next week. He (to supply) the fundamental calculations for designing engines. 2. The Government (to establish) the automobile Research Institute in 1920. But the scientists (to start) auto-making research in 1918). 3. We (not to take) that examination yesterday. We (to have) it in 2 weeks. 4. My father (not to work) in the field of mechanical engineering, he (to design) boats. 5. E.A.Chudakov (to develop) the basic formulas of auto-designing. 6. Nick (to know) mathematics well? – Yes, he does. He (to like) it and (to do) research in this field. 7. You (to work) in the chemistry laboratory a week ago? – No, we didn't. We (to work) there only the day after tomorrow. 8. This program (to include) many problems.

Text 4. THE BRIMINGHAM UNIVERSITY.

Задание. Прочитайте и переведите текст.

The University of Birmingham was founded in 1900. At present it has more than 20,000 students. An emphasis upon research in all schools if one of the characteristics of the University.

Manufacturing and Mechanical Engineering is one of five Schools of Engineering at the University of Birmingham. Its other schools are Chemical Engineering, Civil Engineering, Electronic and Electrical Engineering and Metallurgy and Materials.

The courses given in the School are designed primarily to provide a broad education in the fundamental mechanical engineering sciences and in economics and business studies. The advanced courses in the School of Manufacturing and Mechanical Engineering lead to careers in the fields of design, research, development and production in industry; the government service; the national research laboratories and higher learning institutions; and those in some branches of teaching.

One group of courses serves the Industrial Engineering stream and other serves the Engineering Science stream. The former is intended for students

whose interests lie mainly in the design and production side of engineering, the latter is meant for those who are analytically-minded and who wish to study in depth the theoretical techniques used by engineers. After following a common first year and before entering the second year, students are divided into two streams on the basis of their own choice. The courses of study include mechanical production, electronic and electrical engineering, metallurgy, mathematics and economics. They are supported by laboratory and drawing office exercises. In both cases students are engaged in practical work with engineering firms during the summer vacation.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Прочитайте следующие слова, имеющие общий корень со словами русского языка, и назовите их значения.

mechanical, national, laboratory, career, analytical, theoretical, metallurgy, electrical, **manufacture**, industry, chemical, **civil**, design, firm, characteristics

II. Переведите приведенные ниже словосочетания (модель Adj+N).

broad education, technical management, mechanical engineering, theoretical technique, electrical engineering, electronic engineering, practical work, industrial stream, civil engineering, chemical engineering, national laboratory.

III. Переведите приведенные ниже словосочетания, образованные по модели N+N(чего?), N+N(какой?).

business studies, stress analysis, analogue computation, design project, second-year student, vacation course, engineering firm, summer vacation, steam engine, gas engine, railway carriage

IV. Преобразуйте приведенные ниже словосочетания, образованные по модели N of Adj + N, в словосочетания по модели Adj + N + N.

e.g. The School of Mechanical Engineering
– the Mechanical Engineering School
institutions of higher learning, the stream of Industrial Engineering, the stream of Engineering Science, national laboratories of research

V. Дополните следующую таблицу:

Глагол	Существительное
to design – конструировать	design - конструкция
to mark –	mark -
to research –	research -
to support –	support -
to lead –	lead -
to view –	view -
to talk -	talk -

VI. Переведите на русский язык.

1. Industry usually has ***specialised*** operation. 2. This plant ***specialised*** in producing engines long ago. 3. In this field of industry they start from nothing. 4. The ***start*** was given and the competition began. 5. The scientific ***centre*** of our country is Russian Academy of Sciences. 6. Our thoughts ***centre*** on this idea. 7. My friend ***works*** at the Likhachev automobile ***works.***

VII. Завершите предложения, выбрав соответствующие окончания в правом столбце.

1. The School of Manufacturing and Mechanical Engineering is …	a) by different groups of courses.
2. The courses given include …	b) the Industrial Engineering stream and the Engineering Science stream.
3. After the first year …	c) practical work with engineering firms.
4. They are …	d) one of the five Schools of Engineering and University.
5. Both streams are served …	e) laboratory and drawing office exercises.
6. The Engineering Science stream courses is intended for students …	f) students are divided into two streams.
7. Students who are interested in design and production are supported by …	g) study the Industrial Engineering stream course.
8. The courses of study are supported by …	h) mechanical engineering sciences, economics and business studies.
9. During summer vacations students are engaged in …	i) who wish to study the theoretical techniques.

VIII. Пользуясь информацией текста, расскажите об учебном процессе на механико-технологическом факультете Бирмингемского университета по следующему плану:

а) Место факультета в общей структуре университета.
б) Разделение студентов на два потока (когда и по какому принципу).
в) Предметы, составляющие курс обучения.
г) Практические занятия.
д) Практическая работа (где и когда).

GRAMMAR REVISION
Слова-заместители

Обратите внимание на использование слов заместителей.

One – This complex of plants is the biggest **complex** in the world. – This complex of plants is the biggest **one** in the world.
Ones – He does all the easy jobs and leaves the hard **jobs** for me. – He does all the easy jobs and leaves the hard **ones** for me.
That – This engine is more powerful than **the engine** of the old type. – This engine is more powerful than **that** of the old type.

Those – These experiments are more difficult than **the experiments** in our laboratory. – These experiments are more difficult than **those** in our laboratory.

I. Укажите, в каких предложениях слово one употребляется как слово-заместитель, а в каких – как числительное или неопределенное местоимение. Переведите предложения на русский язык.

1. This automobile complex on the Kama river is the biggest one. 2. The engines of the first cars had only one cylinder. 3. Transport has always been and still remains one of the largest branches in the general system of the world economy. 4. One must choose a profession which he likes. 5. One of the main trends in automobile building is the wide-scale utilization of diesel engines on lorries. 6. My brother has a blue car, and I have a red one. 6. The idea of automation is one of the most important ideas for modern industry. 7. Our old laboratory equipment was worse than the new one. 8. One should always inspect the tool before he begins to work.

II. Укажите, в каких предложениях слово that употребляется как слово-заместитель, а в каких – как указательное местоимение или союз. Переведите предложения на русский язык.

1. Trucks are getting larger and so are the tyres that move them. 2. It is known that air has pressure. 3. There are many shops in that plant. 4. This fuel equipment is more modern than that one. 5. The speed of a passenger-car is higher than that of a bus. 6. There are many interesting stories in this book; read that one on the system of education in Canada. 7. We could use that apparatus for various kinds of tests. 8. We know that electric current consists of the motion of electrons through an electric conductor.

III. Прочитайте следующие предложения и замените, где возможно, существительные словами-заместителями that, one, those. Переведите предложения на русский язык.

1. One group of courses serves the Industrial Engineering stream and the other group serves the Engineering Science stream. 2. Students of the Industrial Engineering Science stream are interested in the design and production engineering and students of the Engineering Science stream study the theoretical techniques. 3. The courses of study are supported by laboratory exercises and drawing office exercises. 4. During the summer vacation students are engaged in practical work with engineering firms.

IV. Глагольная форма в моделях Ved + N и N + Ved переводится:

given taken	-мый -щийся -вшийся -нный -тый

Переведите фрагменты по образцу.

1.the course given … 2. the advanced courses… 3. the theoretical techniques used by …4. specialized operation… 5. analytically –minded students… 6. a written letter…

UNIT II. INVENTORS OF THE WORLD

Text 1. HERO OF ALEXANDRIA

Задание. Прочитайте и переведите текст.

About sixty years after the death of Archimedes, Hero of Alexandria, was born. Nobody knows the exact date of his birth, but according to the best authorities, he lived about 150 B.C. in addition to being a great mathematician, he invented the siphon, the gearwheel, the pump, the water clock and the steam engine.

His book on mechanics translated into Arabic was carefully studied by mechanics and engines of the sixteenth century. In this remarkable book Hero lists and describes five simple ways by which an unusually heavy weight may be lifted and moved with minimum effort. These five principles form the basis of all machinery in the world today and, though described in detail by Hero, their practical application to machinery did not come about for more than a thousand years. They are: the lever, the wheel and the axle, the pulley, the wedge, the screw.

While it is true that the invention of the screw is attributed to Archimedes and the wedge and the lever were known long before Hero's time, he was the man, who showed for the first time that all machinery is based on these five important principles, and how to apply these principles to machinery – such as it was in these early times.

Neither he nor anyone else of his time realized the importance of these inventions. Hero's book on pneumatics, which was translated into Italian in 1549 and later into English, described more than seventy totally useless inventions, most of which embody important basic principles. Their main function was to entertain.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Прочитайте слова, имеющие общий корень со словами русского языка. Значения выделенных слов уточните по словарю.

mathematician, *authorities*, mechanics, engineer, principle, *to list*, to lift, *pneumatics*, *to apply*, function, minimum, practical

II. Выпишите из первого абзаца текста названия изобретений Герона, а из второго абзаца – названия механизмов, к которым были приложены принципы механики, открытые Героном. Найдите русские соответствия слов в словаре.

III. Найдите в словаре значения слов: *weight, effort, to attribute, to entertain, to embody*.

IV. Найдите предложение, которое раскрывает суть законов механики, описанных Героном, переведите предложение на русский язык.

V. Просмотрите текст и определите, в каких абзацах сообщается:
а) о пяти принципах, составляющих основу действия современных механизмов и машин;
об изобретениях, представленных великим древним математиком Героном.

VI. Суммируйте полученную вами информацию о Героне, расположив следующие утверждения в порядке следования их в тексте.

- All his inventions were used to entertain only.
- Hero lived in about 150 B.C.
- Among his inventions are the siphon, the gearwheel, the pump, the water clock, and the steam engine.
- Hero of Alexandria was a great mathematician and inventor.
- Practical application of these five principles to machinery came about more than a thousand years later.
- Hero also showed for the first time that all machinery is based on these principles.
- Hero's book on pneumatics described more than seventy of his totally useless inventions.
- The five principles described by Hero are the lever, the wheel and the axle, the pulley, the wedge, the screw.
- In his book on mechanics, Hero listed and described the five basic principles of mechanics.
- Neither Hero nor his contemporaries realized the importance of his inventions.

VII. Ответьте на вопросы.

1.When did Hero live? 2. What were his famous inventions? 3. Why is his book on mechanics so important for the future of the machinery? 4. What are the five principles of machinery which were listed by Hero. 5. Why were the inventions described in Hero's book useless?

GRAMMAR REVISION
1. Категория залога. (The Category of Voice)

Active Voice (Активный залог)	Passive Voice (Пассивный залог)
1. Значение: Подлежащее предложения N(Subj) выполняет действие.	1. Значение: Подлежащее предложения N(Subj) подвергается воздействию со стороны другого лица или объекта.

2. Форма: V (discuss, discusses) We often **discuss** this problem. He often **discusses** this problem.	2. Форма: be+Ved This problem **is** often **discussed** in class.

2. Перевод пассивного залога.

A. The students ***were provided*** with all necessary materials.

1) Студентов ***обеспечивали (обеспечили)*** всеми необходимыми материалами (глагол в активном залоге в 3 лице мн.ч. с неопределенно-личным значением).
2) Студенты ***обеспечивались*** всеми необходимыми материалами (глагол оканчивается на –ся, -сь).
3) Студенты ***были обеспечены*** всеми необходимыми материалами (глагол «быть» и краткая форма пассивного причастия).

B. The plan ***was changed*** by the engineer.

1) Инженер ***изменил*** план (глагол в активном залоге).
2) План ***был изменен*** инженером (глагол в пассивном залоге).

I. Переведите фрагменты предложений, следуя правилам перевода пассивного залога.

1. His book was studied … 2. The invention is attributed … 3. The wedge and the lever were known … 4. All machinery is based … 5. The book was translated …

II. Переведите следующие предложения на русский язык.

1. Preparatory schools are named so because they prepare pupils for entrance to public schools. 2. Boys and girls are taught together in most British primary schools. 3. A lot of different courses are provided in British colleges of further education, which are for people over 16. 4. These courses are run by almost 500 further education colleges, many of which also provide higher education courses. 5. Teachers are trained at the Teachers' Training College. 6. Some additional information on American system of education will be reported in the newspaper tonight. 7. Modern methods of teaching are hotly debated not. 8. Cambridge is situated at a distance of seventy miles from London. 9. Every college is headed by the Dean.

III. Назовите три формы следующих глаголов. Сгруппируйте те глаголы, которые образуют II и III формы по одинаковой модели.

to speak, to work, to feel, to deal, to come, to grow, to send, to set, to leave, to become, to bring, to shut, to choose, to think, to provide, to know, to bring, to use, to buy, to teach, to break, to spend, to put, to build, to let, to show, to give, to draw, to produce, to catch

IV. Переделайте предложения по следующей схеме.

Model: Many examples ***illustrates*** this rule.
– This rule ***is illustrated*** by many examples.

1. Two laboratories will study this problem. 2. Several examples illustrated this idea. 3. The Academy of sciences organized the conference. 4. Each faculty controls the various subjects of study at this college. 5. The Cambridge University trains about 7,000 students in different specialities.

Text 2. JAMES WATT.

Задание 1. Прочитайте перевод следующих слов. Это поможет вам лучше понять содержание текста.

expertise – мастерство;
milestone – веха;
governor – регулятор;
pressure gauge – манометр (прибор для измерения давления);
sequence - последовательность;
sun/planet gearing – планетарная передача;
to coin the term – ввести термин;
ft lb/min – футо-фунтов в минуту

Задание 2. Прочитайте и переведите текст.

James Watt was born in Greenock, Scotland, and was taught at home. Later he went to Greenock Grammar School. His technical expertise seems to have been obtained from working in his father's work-shop and from early in life he showed academic promise. His early formal training was as an instrument maker in London and Glasgow.

Watt combined the expertise of a scientist with that of practical engineer and later he was not only to improve the heat engine but also to invent new mechanisms.

Watt was interested in making experimental models of steam engines and this marks a historical milestone in engineering development, for they were the first experimental apparatus purposely constructed for engineering research. Watt's early interest in steam arose from experience in repairing a model steam engine in 1764, and in 1765 he invented the separate steam condenser. In 1769 he took out a patent on the condenser in which steam came into direct contact with cold water. That was a milestone by which steam engineering reached its practical and usable form.

In 1784 he took out another patent for a reaction turbine at a time when continental engineers were only considering similar approaches. An improved centrifugal governor was to follow in 1788 and a design for a pressure gauge in 1790.

In the development of the steam engine James Watt represents the perfecting of a sequence of stages beginning with the Newcomen engine and ending with the parallel motion and sun/planet gearing. The latter is said to have been invented by W. Murdock but patented by Watt.

In the scientific field Watt's finest memorial, apart from steam engines, is his establishment of the unit of power – the rate of doing work. He introduced the term horsepower (hp), one horse being defined as equivalent to 33,ooo ft lb/mm.

James Watt died in 1819 in Heathfield, after a life of incomparable technical value. Later, a statue to Watt was placed in Westminster Abbey.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Назовите значения слов, имеющих общий корень.

technical, practical, experimental, models, apparatus, to construct, condenser, patent, reaction, turbine

II. На основании полученной из текста информации заполните следующую таблицу.

Time	Watt's activity and its results
1761	repairing a model steam engine
1765	……
1769	……
1784	……
1788	……
1790	……

III. В чем принципиальное отличие изобретательской деятельности Джеймса Уатта от деятельности Герона? Докажите свою точку зрения, опираясь на содержание текстов 1 и 2.

GRAMMAR REVISION
Глаголы с предлогами в пассиве

Англ.	Русск.	Перевод
to insist **on** to deal **with** to refer **to** to depend **on** to rely **on(upon)** to work **at** to speak **of(about)** to look **at** to take care **of**	настаивать на иметь дело с ссылаться на зависеть от полагаться на работать над говорить о смотреть на заботиться о	This problem was not spoken **of**. – Об этой проблеме не говорили. His opinion cannot be relied **upon**. – На его мнение нельзя полагаться.
to answer to follow to influence	отвечать на следовать за влиять на	The letter was answered. – На письмо ответили.
to make reference **to** to take care **of**	ссылаться на заботиться о	The car must be taken good care **of**. – О машине следует хорошо заботится.

I. Переведите на русский язык.

1. This lecturer is always listened to with great interest. 2. Your friend is very well spoken of. 3. The new equipment can be relied upon. 4. I recommend you to read the article referred to by our professor. 5. When was the doctor sent for? 6. Prof. Smith's lecture was attended by a lot of students yesterday. 7. In this book no mention is made of the British Polytechnics. 8. Care must be taken in using new computer programs. 9. My watch is fast, it cannot be relied upon. 10. Why was he laughed at? 11. These books are needed by all our students. 12. The letter will be answered tomorrow. 13. The lecture was

followed by a heated discussion. 14. This professor is very well spoken about. 15. The speaker, who was listened to with great interest, spoke about the use of the atomic energy for peaceful purposes. 16. I want to have some handbooks on this question, which can be relied on.

II. Раскройте скобки, поставив глаголы в пассивную форму.

1. This student can (to rely on). 2. This equipment must (to take good care of). 3. The new model of Volvo always (to look at) with great interest. 5. Professor Semenov's invention often (to refer to). 5. The program of this subject much (to work at). 6. The whole reference book (to look through), but we couldn't find any answer to the question. 7. Plastics (not to affect) by water. 8. The conditions (to agree upon) yesterday. 9. The lecture (to follow) by a seminar.

III. Преобразуйте следующие предложения в предложения со сказуемым в страдательном залоге.

A.1. Watt started engine manufacturing in 1870. 2. The scientist named his device steam governor. 3. In 1781 Watt produced a rotary-motion steam engine. 4. Watt compared his device to a horse.

B. Model: He ***gave*** me a book.
- The book ***was given*** to me.
- I ***was given*** a book. (другие глаголы, выступающие в аналогичных конструкциях: ***ask, offer, pay, show, teach, tell***)

1. They offered me a job. 2. The engineer showed them the new machine. 3. The U.S. Government gave him the patent for this invention. 4. This college offers students education in the field of engineering.

Text 3. FARADAY PUTS ELECTRICITY TO WORK.

Задание. Прочитайте и переведите текст.

Michael Faraday, who was born in 1791 and died in 1867, gathered together and set in order all the work of the scientists who had worked on electrical problems before him.

His father was a blacksmith, and Faraday was born to work with his hands too. At the age of thirteen he went to learn bookbinding. Once when binding an encyclopedia he ran across an article on electricity. It struck his imagination and aroused his interest. With the little money he could save, he bought a cheap and simple apparatus and set to make experiments. He attended the lectures of Humphry Davy, an outstanding scientist and the most popular lecturer in London at that time. It was Davy who helped Faraday to become assistant at the laboratory of the Royal Institute and to get a profound knowledge of the subject. In 1823 he discovered how to make an electrical motor. In 1831 he built the first generator, then called dynamo. Faraday showed that the relation between magnetism and electricity was dynamic and not static. In 1833 Faraday discovered the laws of electrolysis. The works of many other scientists were influenced by the discoveries made by Faraday. As a result of Faraday's work Morse was able to invent the electromagnetic telegraph; Bell invented the telephone; and Edison devised the electric light.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Назовите значение следующих интернациональных слов.

electrical, problem, motor, generator, dynamo, modern, starting motor, battery, electrolysis, telegraph, telephone, to start, to illuminate

II. Найдите в тексте словосочетания, образованные по модели to V+N, соответствующие русским словосочетаниям.

обобщить работу, привести работу в порядок, получать электрический ток, запустить двигатель, перезарядить аккумуляторную батарею, снабжать электрической энергией, открыть закон, изобрести электрическое освещение

III. Найдите в тексте предложения со сказуемым в страдательном залоге и переведите их на русский язык.

IV. Ответьте на следующие вопросы.

1. When was Michael Faraday born? 2. What did he discover in 1823? 3. What did he build in 1831? 4. Where does the starting motor draw electricity from? 5. How is the generator driven? 6. How is the battery recharged? 7. When did Faraday discover the laws of electrolysis? 8. Whose works are based on the discoveries made by Faraday?

GRAMMAR REVISION
Специальные вопросы (Wh-questions)

Who?		***What?***	***Where?***	***When?***
You	Study	many subjects	at the Institute	every year

1. ***Who*** studies many subjects at the Institute every year?
2. ***What*** do you study at the Institute every year?
3. ***Where*** do you study many subjects every year?
4. ***When*** do you study many subjects at the Institute?

I. Поставьте специальные вопросы к выделенным словам.

1. *A new experimental minibus* was made *at the Likhachev Automobile Works*.(2) 2. There are *many research institutes in our country*.(2) 3. The plant will produce *new types of engines in a few years*.(3)

II. Изучите справку об одном из изобретателей велосипеда – шотландце К.Мак-Миллане. Задайте ссобеседнику специальные вопросы на английском языке по содержанию справки.

Kirkpatrick MacMillan (1813-1878)

- Son of a blacksmith
- Designed and built the first foot-pedal bicycle
- Called the devil on wheels, neighbours thought he was mad

- Fined in 1842 for knocking someone down in the Gorbals
- Did not patent his design and sold it to an English firm for 7 pound sterling

Разделительные вопросы (Tag-questions)

Утвердительное предложение + отрицательный краткий вопрос	**Отрицательное предложение + положительный краткий вопрос**
Mary will be here soon, **won't she**? There was a lot of traffic, **wasn't there**? Jim should pass the exam, **shouldn't he**?	Mary won't be late, **will she**? They don't like us, **do they**? You haven't got a car, **have you**?

III. Закончите следующие предложения, чтобы получить разделительные вопросы.

1. you were born in Russia, ...? 2. You know English, ...? 3. James Watt improved the design of the car, ...? 4. You have read about Henry Ford, ...? 5. You couldn't read about his invention in this book,...?

IV. Изучите справку об известном ученом – лорде Кельвине. Задайте собеседнику разделительные вопросы по содержанию справки.

Lord Kelvin (1824-1907)
- William Thompson, born in Belfast but moved to Glasgow in 1932.
- Studied: the nature of heat;
  laid the ground for the electromagnetic theory of light
  attempted to determine the age of the earth
  planned and supervised the laying of the first transatlantic cable
- "The life and soul of science is its practical application"
- A humble man, married twice but had no children
- Remains lie at Westminster Abbey

Text 4. SOME PROMINENT BRITISH SCIENTISTS

Задание 1. Прочитайте перевод следующих слов. Это поможет вам лучше понять содержание текста.

fluxion - производная;
the calculus - исчисления;
the law of gravitation – закон всемирного тяготения;
the reflecting telescope – зеркальный телескоп;
grinding lenses - объектив;
binary stars – двойные звезды;
nitrous oxide – закись азота;
laughing gas – веселящий газ;
respirable – то, что можно вдыхать;
potassium – калий;
sodium - натрий;
fire-damp - рудничный газ;
the safety lamp – безопасная или рудничная лампа;
benzene - бензол;
an antiseptic to dress wounds – антисептическое средство для обработки ран;

positively charged – положительно заряженный;
the decay of the elements – радиоактивный распад элементов;
mortality - смертность

Задание 2. Прочитайте и переведите текст.

In this article we would like to mention some of the outstanding British scientists and inventors buried or honoured by a memorial plaques in Westminster Abbey, London.

Isaac Newton (1643-1727), one of the greatest scientists of all time, discovered the method of fluxions, later known as the calculus. It was a most important mathematical invention. His second major work was the discovery of the law of gravitation. Then came the formulation of Newton's three laws of motion, the analysis by experiment of white light and the nature of colours, and research on a new type of telescope, called the reflecting telescope. His main publication was "Mathematical Principles of Natural Philosophy", of which there have been several editions. The whole development of modern science begins with this great book.

William Herschel (1738-1822), an astronomer, became expert in grinding lenses and built the largest telescope then known. In 1781 Herschel discovered the planet Uranus, the first such discovery since prehistoric times. His other discoveries include binary stars, two new satellites of Saturn, and infra-red rays from the Sun.

Humphry Davy (1778-1829), a chemist and physicist, prepared and tested nitrous oxide (laughing gas). He discovered that pure nitrous oxide was respirable. In 1807 he succeeded in preparing potassium and sodium by the process of electrolysis. He also investigated the nature of fire-damp, the explosions of which had caused much damage in mines. This investigation led to the invention of the safety-lamp (known as the Davy lamp).

Michael Faraday (1791-1867), a physicist and chemist, contributed greatly to the development of modern science. In 1825 he discovered benzene. However, it is with electricity and electrochemistry that his name is usually linked. He discovered the connection between electricity and magnetism and showed that electromagnetic induction was possible. He used induction to produce the first electrical generator and the first transformer. He was also the discoverer of the laws that control the process of electrolysis.

Charles Darwin (1809-1882), an outstanding naturalist, spent five years on the *Beagle* during her voyage in the Southern Hemisphere (l83l-1836). He made observations of the geology and natural history of the region, and after his return to England he published a book about reef formation, which is still generally considered valid.

In 1859 he published his great work "On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life". One of the most important results of Darwin's work was the demonstration that the evolution of plants and animals gives no evidence of divine guidance. Evolution is the theory that all living things (plants and animals) have developed from earlier and different forms, and have not been specially created. This fact led to a conflict between the upholders of religion and the scientists.

Joseph Lister (1827-1912) was the founder of antiseptic surgery (the use of chemicals to prevent surgical infections). He introduced carbolic acid as an antiseptic to dress wounds. Mortality arising from infected wounds declined

sharply in Lister's ward, and gradually other surgeons began to adopt his methods.

Ernest Rutherford (l87l-I937), the great pioneer of nuclear physics, made fundamental discoveries concerning the nature of radioactivity. He distinguished between the two types of radiation, which he named aIpha and beta rays. In 1919 Rutherford was the first to split the atom by natural means. He deduced the existence of a heavy, positively charged core in the atom, which he called the nucleus. Rutherford received the Nobel Prize for his investigations into the decay of the elements and the chemistry of radioactive substances.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Обобщите информацию текста, заполнив следующую таблицу.

Inventors of the World	Inventions and Discoveries
Isaac Newton William Hershel Humphry Davy Michael Faraday Charles Darwin Joseph Lister Ernest Rutherford	

II. Пользуясь таблицей, перескажите текст.

GRAMMAR REVISION

I. Выберите нужную форму вспомогательного глагола.

1. This plant ... reconstructed only five years ago. (***will be, is, does, was***) 2. Our country ... produce many more automobiles in ten years. (***does, is, will, shall***) 3. These new problems ... not much worked at now. (***will be, are, do, were***) 4. As a rule, cars of this type ... produced by European firms. (***do, are, will be***)

II. Отметьте предложения, в которых нужно употребить пассив при переводе на английский язык. Переведите предложения.

1. Открытие электрона было очень важной вехой в науке. 2. Новая модель этого автомобиля будет выпущена в следующем году. 3. Много лет инженеры работали над созданием этого аппарата. 4. На патент этого изобретателя часто ссылаются в технической литературе. 5. Сколько студентов обучается в вашем институте?

III. Отметьте вопрос, ответом на который может служить следующее.

a) ***Yes, it will.***

1. When will city traffic undergo changes? 2. Did city traffic undergo changes? 3. What undergo changes? 4. Will city traffic undergo changes?

b) ***It was created more than 80 years ago.***

1. what was created in our country? 2. Where was automobile industry created? 3. When was automobile industry created? 4. When was automobile industry created in our country?

IV. Найдите русское предложение, при переводе которого надо употребить глагол *does*. Предложения переведите на английский язык.

1. Кто работает над этой проблемой? 2. Этот завод будет производить в два раза больше автомобилей через пять лет. 3. Когда обычно начинается лекция по химии? 4. Эта лаборатория не занималась конструированием новых моделей автобусов. 5. Используется ли новый тип двигателя на этих автомобилях?

V. Найдите русское предложение, при переводе которого надо употребить глагол *do*. Предложения переведите на английский язык.

1. Кто разработал эту проблему? 2. Производство двигателей на этом заводе в прошлом году значительно увеличилось. 3. Когда вы обычно работаете в лаборатории? 4. Кто испытывает этот двигатель? 5. Где испытывают этот двигатель? 6. Использовался ли новый тип двигателя на этих автомобилях?

V. Закончите предложения, чтобы получить разделительные вопросы.

1. She knows you, … ? a) is she b) isn't she? c) doesn't she?
2. He's right, … ? a) isn't he b) doesn't he c) is he
3. He couldn't go there, …? a) can he b) could he c) couldn't he
4. There is a post-office near here, …? a) isn't it b) is there c) isn't there

UNIT III. ENGINEERING

Text 1. MECHANICAL ENGINEERS

Задание. Прочитайте и переведите текст.

The engineer typifies the 20th century. He is making a vast contribution in design, engineering and promotion. In the organization and direction of large-scale enterprises we need his analytical frame of mind. We need his imagination.

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

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

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

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

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

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

In the 20th century the engineer had at his command many new sources of power. He works hard to develop better materials, especially new alloys for special purposes. He wants to make machinery automatic.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Назовите значения следующих интернациональных слов. Значения выделенных слов («ложных друзей переводчика») уточните по словарю.

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

II. Найдите в 4-8 абзацах английские эквиваленты для слов:

существующий процесс; источники энергии; установка; узлы; сплавы; транспортировка; упорно работать; инженерное умение; ответственный за …; в своем распоряжении

III. Выпишите из 3 и предпоследнего абзацев английские слова и сочетания слов, служащие для обозначения понятий, связанных с деятельностью инженера в конструкторском бюро:

Вид деятельности	Объект деятельности
1. to develop – разрабатывать	New product -
2.	Drawings and specifications -
3. to design	-новая продукция, новые инструменты, узлы, крепления

IV. Выпишите из 2 абзаца английские слова и сочетания слов, служащие для обозначения понятий, связанных с деятельностью инженера в лаборатории.

V. **Пользуясь информацией текста, заполните таблицу, ответив на вопрос: *What does the engineer do?***

At the plant	In the lab	In the designing office
1. …….	1. …….	1. …….
2. …….	2. …….	2. …….
3. ……	3. ……	3. ……
4. ……	4. ……	4. ……

VI. Complete the following sentences:

1. The engineer typifies …	a) the products' performances.
2. He makes a great contribution …	b) deals with the automation of production processes.
3. His main functions are …	c) the 20th century.
4. The engineer also analyses …	d) the analytical frame of mind and imagination.
5. So he can work in …	e) to progress.
6. At present the engineer …	f) designing, developing and testing the products.
7. The work of the engineer requires…	g) the designing office, in the lab and in the production field of engineering.

VII. a)Пользуясь заполненной таблицей и текстом "Mechanical Engineers", расскажите о работе инженера:

1) в области конструирования;
2) в исследовательской области;
3) на производстве.

b)Вы – инженер-конструктор. Расскажите, где вы работаете и чем занимаетесь.

c) Вы работаете в исследовательской лаборатории по испытанию новых узлов (материалов). Скажите, в чем заключается ваша работа.

GRAMMAR REVISION
Категория вида (The Category of Aspect)

Non-Continuous Aspect (Недлительный вид)	Continuous Aspect (Длительный вид)
1. **Значение**: Действие представлено как факт. Отдельные или повторяющиеся действия в настоящем, прошедшем или будущем. 2. **Форма**: *speak, spoke, will speak* 3. **Формальные показатели**: *often, seldom, usually, sometimes, yesterday, tomorrow*	**1. Значение:** Действие представлено как процесс. Незаконченные действия, происходящие в настоящем, прошедшем или будущем. **2. Форма: be+Ving** **3. Формальные показатели:** *now, still, at present, at that time, придаточные времени, точное указание на время.* **4.** He *is working* at this plant now. *Is* he *working* at this plant now? - No, he is not. Yes, he is.

I. Сравните следующие предложения и переведите их на русский язык.

1. Our engineers work hard at this problem. Look at these two men – they are working at a new problem. 2. Our autoplants produce all the main body components. This plant is producing only tyres now. 3. "Moskvitch 2141" has the speed about 150 kilometres per hour. Look at this car. I think it is doing 160 km per hour now. 4. They designed this instrument for laboratory research last year. When we visited their institute they were designing the new

equipment. 5. The millionth electric motor is rolling off the conveyer line of the plant now. Representatives of more than 80 professions took part in its manufacture. Next year the plant will be producing 1,000 electric motors every day.

II. Используйте следующие предложения для описания современного состояния науки.

Model: The volume of scientific information did not grow so rapidly in the 19th century.
– The volume of scientific information is growing very rapidly now.

1. Knowledge did not expand so rapidly in the 19th century. 2. Not so many people took part in research in the 19th century. 3. Scientists did not work in big research teams in the 19th century. 4. Not so many new branches of science appeared in the 19th century. 5. Research centres did not grow so rapidly in the 19th century. 6. Scientific thinking did not develop so rapidly in the 19th century. 7. Scientists did not publish so many papers in the 19th century.

III. Покритикуйте следующие заявления, употребив *not ... enough*.

Model: The situation is improving.
– Quite true, but it is not improving rapidly enough.

1. We are using this technique effectively. 2. Scientific contacts are expanding. 3. He is doing this work well. 4. Research methods are improving. 5. This process is going rapidly. 6. Technology is developing. 7. Our knowledge of the world is growing.

IV. Поставьте глагол в скобках в нужную форму времени и вида.

1. I know she (to prepare) for a difficult experiment now. 2. What you (to do) when I (to come) in? – I (to read) an article on the British educational system. 3. I thought you (to do) this work yesterday. – Yes, and I still (to do) it. 4. Tomorrow at 6 o'clock I (to report) the results of their analysis. 5. Our laboratory will be provided with new equipment. These two engineers (to mount) a new electronic system. 6. Research centres (not to grow) so rapidly in the 19th century. But they (to grow) very rapidly now.

Text 2. EDUCATING TOMORROW'S ENGINEERS.

Задание 1. Прочитайте перевод следующих слов. Это поможет вам лучше понять содержание текста.

to condense down – уменьшать до;
objective – цель;
to recognize – определять, признавать;
to encourage – поощрять;
interchange – (взаимо)обмен

Задание 2. Прочитайте и переведите текст.

Engineering education developed very differently on the Continent and in the UK. On the Continent, engineering and technical sciences were set up in technical universities, while in the UK engineering departments were set up in multi-discipline universities. As a consequence, engineering education developed on the Continent as a more professionally oriented subject, while in the UK the emphasis was on engineering science. Perhaps because of their size and their more professional engineering-oriented courses the Continental technical universities have developed a much closer relationship with industry. In Germany, the Herr Professor is also likely to be a Herr Director and there are many visiting industrial professors, who will spend a day a week in the University. In France much of the lecturing is provided by staff from the appropriate industries. There is nothing similar in UK engineering departments.

The question is what is to be done about engineering education in the UK? In the opinion of Britain's specialists, 70 to 80 engineering faculties in English universities and polytechnics should be condensed down into 20 or so major technical universities. They should become more industrially-oriented.

Lastly, the objective of engineering education and training should be recognized. So what should be the objective of undergraduate education? It is to educate and train people to think and search out knowledge for themselves, and to have the self-assurance to apply it to the job in hand. Many of the courses are now much too intensive and students have too little time or encouragement to read and think for themselves. The solution is to recognize that it is impossible to cover all the subjects which an engineer may find useful in a lifetime, and realize that if he has been correctly educated he can read up on subjects which he may need as he progresses in his career.

However, industry must recognize that a graduate will need training in the specific area in which he is working, and must also be prepared to encourage him to attend continuing education courses and/or seminars and conferences as appropriate. It is clear that there is to be much more interchange of staff between industry and higher education.

The education and training of engineers must be a partnership between industry and higher education, which extends from undergraduate education and training through to post-graduate short and long courses and research.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. a) В первом абзаце текста сравнивается система высшего технического образования в Великобритании и на континенте. Есть ли различия между ними? Какие?

b) Оставшаяся часть текста является ответом на вопрос: What is to be done about engineering education in the UK? Перечислите изменения, которые, по мнению автора, должны быть внесены в систему технического образования Великобритании.

c) Одним из способов улучшения подготовки инженеров является сотрудничество высших учебных заведений с промышленностью. В чем оно должно проявляться? Подтвердите свой ответ ссылкой на текст.

GRAMMAR REVISION

COMPLEX OBJECT (with the Infinitive): N+ let (make, put, allow, cause)+ N + V или toV

a) The professor allowed *his students to use* calculators. – Профессор разрешил студентам пользоваться калькулятором.
b) The teacher made *him repeat* the rule. – Учитель заставил его повторить правило.
c) I know *him to have left* for Moscow. – Я знаю, что он уехал в Москву.

I. Найдите сложное дополнение с инфинитивом в следующих предложениях.

1. The Industrial Revolution began by putting water and steam to work. 2. James Watt devised the concept of horsepower to make his customers understand the amount of work his machines could perform. 3. The great heat made the engineer utilize other working conditions. 4. Weakness in the metal causes engineers to reinforce it with artificial fibers. 5. The professor wants the students to carry out some experiments. 6. The laboratory assistant expects the devices to have been repaired some days ago. 7. The technician felt something heavy strike the platform. 8. We know him to have worked out a new method of applying quantum generators in medicine. 9. I'd like this reaction to be repeated. 10. We know this scientist to have been working at this problem for some years.

II. Вставьте вместо пропусков глаголы: *to enable* – давать воэможность; *to allow* - позволять; *to make* - заставлять; *to cause* – вызывать. Переведите предложения на русский язык. Обратите внимание на то, что после глагола *to make* в значении «заставлять» инфинитив употребляется без *to*.

1. The rise in temperature ... the mercury ... rise up the tube. 2. The motorway ... motorists ... travel from London to Birmingham much more quickly than before. 3. The use of tractors ... more food ... be produced more cheaply. 4. The presence of oxygen ... the mixture ... burn rapidly. 5. The increase in exports ... the country ... import more raw materials. 6. The risk of an explosion ... the workers ... leave the factory. 7. The sharp rise in temperature ... the engine ... overheat. 8. The presence of non-metallic constituents in iron ... it ... behave in various ways. 9. The growth of industrial towns ... many people ... leave the countryside. 10. The different gear ... the two rear wheels ... turn at different speeds.

III. Переведите приведенные сочетания слов.

A. Обратите внимание на то, что инфинитив, стоящий после глагола-сказуемого может быть обстоятельством цели.

Например: They were used *to provide* ...
- Их использовали (для чего?), *чтобы обеспечить* ...

1. ... wind was used to provide energy... 2. ... water was used to provide energy ... 3. ... the concept "horsepower" was devised to make customers ... . 4. This problem is too complex to be solved by the students. 5. They hoped to be sent to the conference.

В. Если после глагола-сказуемого стоит существительное, а после него инфинитив, то инфинитив может быть или обстоятельством цели, или определением к существительному.

Например: He devised this concept *to calculate* the amount of work.
– Он изобрел это понятие, *чтобы подсчитать* количество работы.
He invented steam engine *to perform* work.
– Он изобрел паровой двигатель *для производства работы* (*который будет производить работу).*

1. They discovered ways to refine metals. 2. James Watt devised the concept of horsepower to make his customers understand … 3. The engineer has the ability to calculate … 4. He has stronger materials to work with… 5. This method is accurate enough to give reliable results.

TEXT 3. THE ENGINEERING PROFESSION

Задание. Прочитайте текст и определите:
а) о каких инженерных профессиях идет речь в первом абзаце;
б) о каких механизмах и машинах сообщается в третьем абзаце;
в) в связи с чем упомянут XIX век в последнем абзаце.

Engineering is one of the most ancient occupations in history. Without the skills included in the broad field of engineering, our present-day civilization never could have evolved. The first toolmakers who chipped arrows and spears from rock were the forerunners of modern mechanical engineers. The craftsmen who discovered metals in the earth and found ways to refine and use them were the ancestors of mining and metallurgical engineers. And the skilled technicians who devised irrigation systems and erected the marvelous buildings of the ancient world were the civil engineers of their time.

Engineering is often defined as making practical application of theoretical sciences such as physics and mathematics. Many of the early branches of engineering were based not on science but on empirical information that depended on observation and experience.

The great engineering works of ancient times were constructed and operated largely by means of slave labor. During the Middle Ages people began to seek devices and methods of work that were more efficient and humane. Wind, water, and animals were used to provide energy for some of these new devices. This led to the Industrial Revolution that began in the eighteenth century. First steam engines and then other kinds of machines took over more and more of the work that had previously been done by human beings or by animals. James Watt, one of the key figures in the early development of steam engines, devised the concept of horsepower to make his customers understand the amount of work his machines could perform.

Since the nineteenth century both scientific research and practical application of its results have escalated. The mechanical engineer now has the mathematical ability to calculate the mechanical advantage that results from the complex interaction of many different mechanisms. He or she also has new and stronger materials to work with and enormous new sources of power. The Industrial Revolution began by putting water and steam to work; since then

machines using electricity, gasoline, and other energy sources have become so widespread that they now do a very large proportion of the work of the world.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Во втором абзаце текста вы встретили термин *empirical information,* в третьем абзаце — термин *horsepower,* в четвертом — *mechanical advantage.* Как переводится каждый из этих терминов? Выпишите их значения из словаря. В связи с чем упомянут каждый из этих терминов в соответствующем абзаце?

II. Выпишите из текста:
- **a) названия всех механизмов и машин прошлого и назовите соответствующие им русские термины;**
- **b) виды источников энергии и назовите соответствующие им русские эквиваленты.**

III. Прочитайте и переведите следующие слова.

engineering, civilization, modern, metal, construction, to refine, metallurgical, irrigation, practical, physics, empirical, application, occupation, civil, human, observation

IV. Пользуясь информацией из текста, дополните таблицу.

Engineering specialty	Its forerunner	Its function
Mechanical engineer	tool-makers who chipped arrows and spears from rock	to make tools and machinery
Mining engineer		
Civil engineer		
Metallurgical engineer		

V. Ответьте на вопросы по теме “The Engineering Profession”.

1. Who were the forerunners of modern mechanical, mining and metallurgical, and civil engineers? 2. How is engineering often defined? 3. What kind of information were many of the early branches of engineering based on? Give some examples. 4. Name two important factors in the explosion of scientific knowledge in modern times. 5. What made people in the Middle Ages in Europe begin to experiment with new devices and methods of work? 6. What was the historical result of experimentation with different kinds of energy? 7. Who was James Watt? Why did he devise the concept of horsepower? 8. What advantages have scientific research and its applications given to the mechanical engineer? 9. What energy sources have come into common use since steam engines were developed at the beginning of the Industrial Revolution?

GRAMMAR REVISION
Категория временной соотнесенности: Perfect/Non-Perfect

Non-Perfect	Perfect
1. Значение: Не уточняет характера действия и служит для выражения отдельных или повторяющихся действий в настоящем, прошедшем или будущем. **2.Форма**: *speak, spoke, will speak* **3.Формальные показатели:** *often, seldom, always, sometimes, frequently, yesterday, tomorrow*	**1. Значение:** Выражает действие, законченное к какому-то моменту в настоящем, прошедшем или будущем. **2. Форма:** *have (has) spoken* **3. Формальные показатели:** **a)** действие закончено, результат действия налицо: *just, ever, never, already, just, yet, lately, since 5 o'clock, by the time you come …* **b)** Действие закончено, а время действия – нет: *today, this week, this winter, this month, this year*

I. Переведите следующие предложения на русский язык.

The ZIL Works has already manufactured a new truck model with an engine that is protected against cold. 2. Every object of our industrialized world has practically flown from the machine. 3. The construction of the KAMAZ complex within such a short period has become possible only by using the latest achievements of science and technology. 4. Graduation theses of these students were based on material they had accumulated while working at the Student Design Bureau. 5. Before the production began the planning engineer had ordered the material, the tool engineer had designed the tools and the design engineer had given the specification on the drawings, 6. The chemical engineer will have completed the experiments by the 21st of June. 7. Michael Faraday gathered together and set in order all the work of the scientists who had worked on electrical problems before him.

II. Раскройте скобки, поставив глаголы в нужную форму.

1. He (to like) physics and mathematics when he (to be) at school. 2. Let's try to answer questions which you (not to ask) yet. 3. Several famous scientists (to make) reports at the conference yesterday. 4. I already (to see) this device at the exhibition. 5. When you (to discuss) this problem with your chief engineer? – We (to discuss) it a few days ago. 6. Radical changes (to take place) in this country since then. 7. After the planning engineer (to order) the material and the tool engineer (to design) the tools, production (to begin).

TEXT 4.

Задание: Прочитайте текст и выберите заглавие к нему.

I. Development of Engineering.
II. Science and Engineering.
III. Engineering Specialties.

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

Engineers design and make machines, equipment and the like. Such work requires creative ability and a working knowledge of scientific principles. The engineer must also have an understanding of the various processes and materials available to him/her and could be working in any of the following areas: the organization of manufacture, research and development, design, construction, sales and education.

Because of the large number of engineering fields today there are often many different kinds of engineers working on large projects such as the development of nuclear power or new aircraft. In the design of a new aircraft mechanical engineers work not only on the plane's engines but on other mechanical aspects such as the braking system. When the aircraft goes into production mechanical and industrial engineers are involved in designing the machines necessary to fabricate the different parts as well as the entire system for assembling them. In both phases of such a project mechanical engineers work with specialists in fields such as aerospace and electronic engineering. Each engineer is a member of a team often headed by a systems engineer able to combine the contributions made by all the different disciplines.

Another result of the increase of scientific knowledge is that engineering has become a profession. A profession is an occupation like law or medicine that requires specialized advanced education. Today it requires at least four or five years of university study leading to a Bachelor of Science degree. More and more often engineers, especially those engaged in research, get an advanced master's or doctor's degree. Even those engineers who do not study for advanced degrees must keep up with changes in their profession. A mechanical engineer who does not know about new materials cannot successfully compete with one who does.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Вы ознакомились с содержанием текста. Как вы поняли из контекста значение словосочетаний – *industrial engineer, systems engineer*?

II. Суммируйте информацию текста, закончив следующие высказывания соответствующими окончаниями из правого столбца.

1. Engineering is based on…	a) to the growth in the number of engineering fields.
2. The rapid increase of scientific knowledge leads…	b) that each engineer keeps up with changes in his profession,
3. Another result of the increase of scientific knowledge is…	c) a large number of different kinds of engineering specialties.
4. Profession is an occupation…	d) that requires specialized advanced education,
5. Because of the large number of engineering fields the development of a complex mechanism requires…	e) that engineering has become a profession.

III. Дополните составленный вами рассказ информацией из текста "The Engineering Profession" и сделайте сообщение на тему "Engineering and Engineering Profession."

GRAMMAR REVISION
Модальные глаголы (Modal Verbs)

Модальные глаголы	Эквиваленты модальных глаголов	Значение	Примеры
Can (could) – могу, может, умею, умеет	to be able (to) to be unable (to)	физическая, умственная возможность	I *can lift* this unit. He *was able to* do this work himself.
May (might) – могу, может, может быть, возможно	to be allowed (to), to be permitted (to)	разрешение, вероятность	You *may take* the book. The students *were allowed to* test the device.
Must – должен	to have (to)- быть вынужденным to be (to) – быть обязанным to be supposed – быть обязаным to be obliged – быть вынужденным	долженствование, обязанность а) в силу обстоятельств б) в силу договоренности в) в силу договоренности г) в силу морального обязательства	Every student must attend the lectures. He had to do it again. We are to meet at 6 p.m. I am obliged to help him.

I. Трансформируйте следующие предложения в прошедшее и будущее время, используя соответствующие формальные показатели времени. Переведите трансформированные предложения.

Model: The engineer ***must*** know all the properties of this material.
The engineer ***had to*** know all the properties of this material.
The engineer ***will have to*** know all the properties of this material.

1. You must use this equipment. 2. The scientists can test their new apparatus in the laboratory. 3. This plant can provide our research institute with a new type of fuel equipment. 4. This scientist may investigate new means of production. 5. Our scientific research laboratory must launch a new programme

this year. 6. New tyres of this plant can have the longer period of their durability. 7. He may use the reference books for his report. 8. Nobody can lift this heavy tyre.

II. а) Найдите в тексте предложения с указанными в таблице моделями и переведите их на русский язык.
б) Определите, какие из высказываний соответствуют содержанию текста.

1.The technologist ***is to*** solve practical problems. 2. The engineer ***is to*** integrate the work of the essential triangle. 3. The scientist ***has to*** design products, machines and production systems. 4. The technologist ***is to*** investigate the unknown. 5. The engineer *must* apply engineering tables and formulas in his work. 6. The pure scientist ***is to*** work in the area of applied science and research. 7. The engineer ***should*** apply his theoretical knowledge to practice.

III. Переспросите о происходящем действии и дайте отрицательный ответ на вопрос. Переведите предложения на русский язык.

Model: He ***had to meet*** this delegation of engineers from Tula plant.
– ***Did*** he ***have to meet*** this delegation from Tula plant?
– No, he didn't. He ***didn't have to meet*** this delegation from Tula plant.

1. All the units of a new tractor can be produced at this plant. 2. Our laboratory has to launch a new program this month. 3. The scientist was allowed to take part in the conference on automobile designing. 4. This new minibus can hold 18 passengers. 5. Everybody must be present at the lecture of Prof. Smith. 6. This new plant is to build only body fixtures. 7. She may use this new device for testing the design.

Text 5. THE ESSENTIAL TRIANGLE

Задание. Бегло просмотрите текст 5 и скажите:
а) связан ли он по тематике с предыдущими текстами данного цикла;
б) в каких абзацах текста содержится информация о работе инженера;
в) в каком абзаце текста расшифровывается понятие "the essential triangle";
г) раскрывает ли заглавие "The Essential Triangle" содержание текста. Предложите свои варианты заглавия.

Technological and industrial progress depends on the scientist, the engineer and the technologist — an essential triangle. Each makes major contribution to progress. The engineer depends upon the scientist for new knowledge and upon the technologist for specialized assistance in translating engineering plans into operating reality.
The pure scientist can make his contribution to progress through the investigation of the unknown.

The interests of the research engineer are in the area of applied science and research. Scientists work in a world of generalizations and abstractions. The technologist, on the other hand, works in the real world of specific things

and concrete objects. His problems are practical and they require practical solutions. He is more interested in how to do things. He must understand engineering tables and formulas and apply them in his work. The scientist, the research engineer, the technologist —all play an important role in the modern world.

The principal work of the engineer is design. He has to design products, machines and production systems. Like the research engineer, the engineer asks "why?". Like the technologist, he is also concerned with "how?"

The engineer must combine many of the characteristics of the scientist, research engineer and technologist. He must have a basic knowledge of the sciences, and understanding of the abstract techniques of the research engineer and he should know much of the technology employed by technologists.

Perhaps the most important function of the engineer is to integrate the work of the essential triangle. His interest must be in combining the abstract-theoretical world and the technical-practical world.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. а) Переведите на русский язык следующие слова и словосочетания. Значения выделенных слов – «ложных друзей переводчиков» – уточните по словарю.

technological progress, industrial progress, specialized assistance, reality, abstraction, concrete object, specific, table, formula, role, modern, principal, to combine, basic, abstract techniques, function, to integrate

б) Найдите предложения с данными словами и словосочетаниями в тексте и проверьте по контексту правильность выбранных вами значений.

II. а) Найдите в тексте существительные, образованные от приведенных ниже глаголов и уточните их значения.

to know, to contribute, to assist, to investigate, to generalize

б) Найдите в тексте глаголы, от которых образованы приведенные ниже существительные, и уточните их значения.

requirement, combination, integration

III. Найдите в первом—четвертом абзацах английские эквиваленты следующих русских словосочетаний и слов.

прикладная наука и исследования, главная работа, практические решения, применять, производственные системы, подобно, играть важную роль, зависеть от, проектировать машины

IV. Пользуясь информацией текста, заполните таблицу.

Сфера деятельности	Деятель
new knowledge	scientist
work in the area of applied science	

and research	
translating engineering plans into operating reality	
production process	
designing products, machines, production systems	

V. Расскажите о роли ученого, инженера и технолога в научно-техническом прогрессе, используя следующие словосочетания и активную лексику:

the essential triangle, to consist of, to make contribution to progress, to investigate the unknown, to deal with the production process, to design new products, to integrate the work, object, area, knowledge, investigation, generalization, abstraction, solution, assistance, to abstract, to generalize, to apply, to employ, principal, basic, practical, theoretical, essential, major, technical.

VI. Заполните пропуски с следующем тексте, выбрав слово из предлагаемых вариантов.

Manufacturing Engineer of the 21st Century.

The … (human, primary, abstract) role of the manufacturing engineer in the 21st century will be … (to calculate, to observe, to perform) and to integrate various manufacturing functions. More and more the manufacturing engineer will be an operations integrator.

Manufacturing engineers understand product design processes and … (machinery, physics, steam engines). They … (provide, invent, assemble) planning of manufacturing and designing of machinery. They deal with … (performing, analyzing, designing) and investigating equipment needs.

Manufacturing engineers must have … (experience, assistance, information) in work with individuals at all levels of an organization, from upper-level management to factory-floor operators of high-technology … (observation, assembly, specification) stations.

In short, they work … (to depend upon, to assemble, to develop) and coordinate the entire manufacturing process from … (product, performance, area) design through after-sales service.

Text 6. THE ROLE OF SCIENCE IN MANUFACTURE

Задание 1. Прочитайте следующие слова и словосочетания. Они помогут вам полнее понять содержание текста.

in turn – в свою очередь;
way – метод, способ;
to be familiar with – знать ч-л, быть в курсе ч-л;
tool engineer – технолог;
common – общий;
approach – подход;

advanced engineering courses – курсы повышения квалификации для инженеров;
complicated — сложный

Задание 2. Прочитайте и переведите текст.

Future improvements in productivity are largely dependent on the application of science to manufacturing. This depends in turn on the availability of large numbers of scientifically trained engineers. Higher schools can serve the needs of industry in two ways: by performing basic research and by training well-qualified engineers in the manufacturing field.

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

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

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

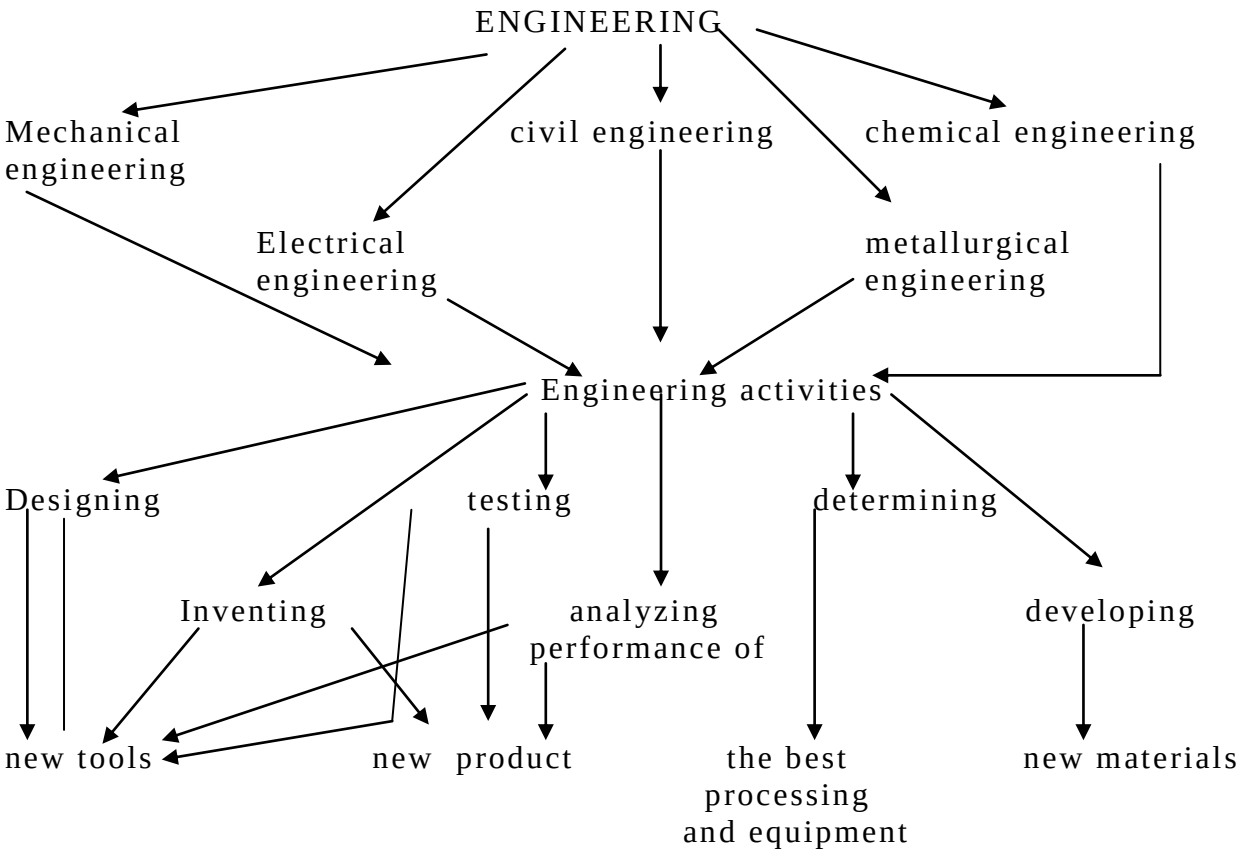
TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Прочитайте следующие утверждения и расположите их в порядке следования информации в тексте:

a) An engineer does not finish his education when he receives his diploma.
b) There is a close cooperation between industry and education,
c) The higher school can serve the needs of industry.

II. На чем основано каждое из этих утверждений? Подтвердите свой ответ ссылкой на текст.

• Ориентируясь на основные блоки схемы, составьте план сообщения по теме "Engineering Profession".
• Сделайте краткое сообщение на английском языке по каждому пункту плана, ориентируясь на «подблоки» схемы.



UNIT IV. MACHINE-BUILDING

Text 1. ENGINEERING.

Задание. Прочитайте и переведите текст.

Today machines have to withstand such tremendous stresses and to be able of such complex motions that complicated and specialized calculations taking hundreds of factors into account are needed in the design of even quite a simple machine like a motor-car engine.

So, as engineering progresses, engineers must become ever more scientific and specialized. Today the branches of engineering are so wide that it is impossible to classify them satisfactorily. But we may try to divide them into uses. The main divisions of engineering may be listed as follows:

1. Mechanical engineering.

Steam engines, internal combustion engines, turbines (steam, gas, water), pumps; compressors; machine-tools; mechanisms.

2. Electrical engineering.

a) Power: generators; motors; transformers; transmission (power lines etc.).

b) Electronics: radio, radar, television.

3. Civil engineering. Dams; tunnels; roads, and so on.

4. Structural engineering.

The structural details of all large buildings and bridges.

6. Chemical engineering.

Any of these branches of engineering may require the special services of the following specialists' the metallurgist; the strength of materials expert; the thermodynamics of heat expert, the mechanics or machines experts; the various production engineering experts such as the engineering designer or the tool designer; the mathematician specializing in engineering problems and many more. The engineer must also deal with the economists to assure himself that he is producing what is wanted, and economically.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Переведите следующие слова и словосочетания на русский язык. Назовите значения интернациональных слов, проверьте правильность вашей догадки по словарю.

metallurgist, expert, mechanics, structural engineering, chemical engineering, mathematician, generator, civil engineering, heat expert, tool designer, economist, electrical engineering, engineering designer, strength of materials expert, turbine, tunnel, engine, steam engine, internal combustion engine

II. Завершите предложения, подобрав соответствующие окончания в правом столбце.

1. At present there are …	a) more scientific and specialized.
2. It is very difficult …	b) the special services of specialists from various branches.
3. The main divisions of engineering are …	c) numerous branches of engineering.
4. So, engineers must become …	d) complicated and specialized calculations are needed.
5. In designing even a simple machine …	e) to give a satisfactory classification of these ranches.
6. Thus, any branch of engineering may require …	f) Mechanical engineering, electrical engineering, civil engineering, structural engineering and chemical engineering.

III. Заполните таблицу по образцу.

Branch of Engineering	Specialist	Object of Work
1. civil engineering	civil engineer	dams, tunnels, roads…
2. mechanical engineering		
3. electrical engineering a) b)		 a) b)
4. structural engineering		
5. chemical engineering		

IV. Воспользовавшись заполненной таблицей, расскажите об основных отраслях техники, специалистах, работающих в этих отраслях, содержании их работы.

V. Прочитайте о том значении, которое имеют технические специальности в экономике Великобритании. Передайте основную идею текста.

So What Is Engineering?

The engineering industry makes most of the things that are essential and useful: aerospace, cars, hospital equipment, telecommunications and even the humble kettle. Engineering also makes most of the things other industries need from cash dispensers and electronic mail for the banking industry to microphones and staging for the entertainment industry. In the production of everything from chocolates to the Channel Tunnel, the key individuals are the engineers. It's an industry that still contributes significantly to the wealth of the UK, the very diverse manufacturing industry sector alone generates around a third of the national wealth and employs approximately 32 percent of the working population.

In recent years, engineering has changed out of all recognition. The sheer speed of change in many manufacturing technologies is startling. Thanks to the introduction of computers and new technologies like Virtual Reality, people are more in control than ever. This also means the engineering employers are looking for people with a wider range of skills and personalities: from lone-theorists to more gregarious and practical individuals; from managers who can handle people, lead teams and solve problems, to creative designers with a keen sense of market realities. Engineering needs them all — women as well as men.

GRAMMAR REVISION
Continuous Passive

a) A new plant (to construct) on the Volga now. – A new plant **is being constructed** on the Volga now.
b) The problem (to discuss) at 5 p.m. yesterday. – The problem **was being discussed** at 5 p.m. yesterday.

I. Переведите следующие предложения.

1. Much attention is being given at present to the modern equipment of research laboratories. 2. The idea of constructing a new auto plant was being widely discussed some years ago. 3. Much is being done to improve the conditions for research work. 4. wide investigation is being carried on in the field of machine-building now. 5. Many old plants and shops are being expanded and reconstructed now.

II. Раскройте скобки и поставьте глагол в нужную форму времени, залога и вида.

1. The question about a new laboratory (to discuss) at a special meeting yesterday at 6 p.m. 2. Different types of cars and lorries (to produce) in our country now. 3. This plant (to achieve) great results in producing fuel equipment years ago. 4. Many new service centres (to build) in our country now. 5. The work still (to go on). 6. My friend (to work) at a new design of this forging when I (to come) to his laboratory a week ago. 7. Different body

fixtures (to test) in this laboratory at present. 8. What you (to do) when I (to come) in? – I (to read) an article on internal combustion engines. 10. The scale of producing a new car (to increase) with every passing year. 11. This new model (to produce) by the Volzhky Car Works in Togliatti. 12. Our specialists and representatives of the Renault Company of France (to work out) the technological processes of manufacturing the engines. 13. Advanced technologies (to apply) in most branches of engineering.

III. Подберите необходимые формальные показатели к следующим предложениям.

1. Some progress is being made in machine-building. (last year, regularly, at present) 2. When I came to their plant a new model of the sporting car was being tested. (tomorrow, still, soon, now) 3. The greatest importance is given to the further development of gas equipment. (yesterday, now, today, at that time) 4. The process of the technical re-equipment of transport is going on. (soon, continuously, at that time) 5. The automobile industry is making progress in all types of transport. (tomorrow, next month, a year ago, soon, nowadays) 6. It is expected that cars with less toxic exhaust gases will be widely used. (now, last year, at present, in future, tomorrow)

IV. Составьте предложения, используя следующие формы глагола; не забудьте о формальных признаках.

1. … was investigating… 2. … is supplied … 3. … will design… 4. … is being established… 5. … will be reconstructed … 6. … was being operated … 7. … is provided … 8. …will be expanding … 9. … was being developed …

Text 2. MECHANICAL ENGINEERING.

Задание. Прочитайте и переведите текст.

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, steam engines, machine-tools, pumping machinery, turbines and locomotives of that time made such a diversity interest for civilian engineers that these and allied subjects were called mechanical engineering.

Mechanical engineering deals with the design, construction and operation of machines and devices of all kinds, and with research and sciences upon which these 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 engineering enters into the work of all engineers whose machines are to be developed for the processes of specialists of the other branches of engineering. To understand better the extent of the activities and interests of mechanical engineers, the following lists of the professional divisions and technical committees of the American Society of Mechanical Engineers (ASME) are given.

Professional divisions; applied mechanics, aviation, fuel, graphic arts (printing), heat transfer, hydraulics, industrial instruments and regulators, management, materials handling, metals engineering, oil and gas power, process industries, production engineering, railroad, rubber and plastics, textiles, wood industries.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Какое событие, связанное с утверждением машиностроения как отдельной отрасли промышленности, упомянуто в первом абзаце текста.

II. Просмотрите второй абзац текста и определите связь между этим текстом и текстом 'Engineering'.

III. В третьем абзаце текста дается классификация отраслей и подразделений Американского общества инженеров-механиков. Какие из этих отраслей были отмечены в тексте 'Engineering'?

IV. Заполните схему, используя информацию текста.

Mechanical Engineering

machines and devices	professional division
1)	1)
2)	2)
3)	3)
4)	4)
5)	5)

GRAMMAR REVISION
Perfect Passive

I. Переведите предложения, обращая внимание на значение глагольных форм.

1. All means of production have been recently modernized in this field. 2. Sixteen specialized plants including the first section of a plant in Cheboksary for the manufacture of heavy-duty tractors for melioration and construction work had been put into operation by the end of 1975. 3. The development in all fields of science and technology has always been marked by a desire to advance man's potentialities in all directions. 4. Great attention has been paid to have materials whose properties can be changed and controlled. 5. Every tool, machine and material used by the engineer to accomplish his purpose stems directly from machine-tools or has been evolved from machines which themselves were produced by machine-tools. 6. All these components have been developed into a complicated mechanism, detailed drawings have been made of all component parts.

II. Заполните пропуски во втором предложении пассивной формой глагола из первого предложения. Переведите предложения.

1. This complex has produced many new types of vehicles recently. – Many new types of vehicles … at this complex recently. 2. The KAMAZ plant has occupied a huge territory of almost 1,000 hectares. – A huge territory of almost 1,000 hectares … by KAMAZ plant. 3. After the engineer has finally checked the drawings and found them satisfactory, materials are ordered. – After the drawings … finally and found satisfactory, materials are ordered. 4. The scientists have proved that materials may exist whose properties are as superior to those of diamond as diamond is superior to carbon. – It … by scientists that materials may exist whose properties are as superior to those of a diamond as diamond is superior to carbon. 5. Our specialists and representatives of the Renault Company of France have worked out the technological processes of manufacturing the engines. – Technological processes of manufacturing the engines … by our specialists and representatives of the Renault Company.

III. Раскройте скобки и поставьте глагол в нужную форму времени, вида, временной соотнесенности и залога.

1. Our plant (to reequip) recently with every facility for body work including cold stamping of the main body components. 2. New machines (to design) nowadays to deal with new problems which continually arise in modern industry. 3. More than half a century ago the phenomenon of superconductivity (to discover). 4. At present great progress (to make) in technical re-equipment of automobile transport. 5. This new model (to produce) by the Volzhsky Car Works in Togliatti. 6. An all-plastic car (to exhibit) lately: nearly the whole car except the engine and transmission is of plastics or reinforced plastics.

Text 3. TRENDS IN THE MODERN MACHINE-BUILDING INDUSTRY

Задание. Прочитайте текст и определите:
1) о каких двух основных направлениях современного машиностроения упоминается в первом абзаце;
2) в каком абзаце перечисляются новые виды автоматизированных машин и механизмов;
3) в каких абзацах говорится о методах повышения срока службы и надежности современных машин.

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. The machine modules on a large scale are well suited for "unmanned" industries. Intense work is being carried out on new robots. What we need is not merely manipulators which can take up a workpiece and pass it on, but robots which

can identify objects, their position in space, etc.

We also need machines that would trace the entire process of machining. Some have been designed and are manufactured. Modern engineering thinking has created new automated coal-digging complexes and machine systems, installations for the continuous casting of steel, machine-tools for electrophysical and electrochemical treatment of metals, unique welding equipment, automatic rotor transfer lines and machine-tool modules for flexible industries.

New technologies and equipment have been designed for most branches of engineering. In the shortest time possible the engineers are to start producing new generations of machines and equipment which would allow manufacturers to increase productivity several times and to find a way for the application of advanced technologies.

Large reserves in extending service life for machines can be found in the process of designing. At present, advanced methods have been evolved for designing machines proceeding from a number of criteria. Automatic design systems allow for an optimizing of the solutions in design and technology when new machines are still in the blueprint stage. A promising reserve in increasing the life of parts is strengthening treatment. In recent years new highly efficient methods have been found.

First and foremost of them is the vacuum plasma methods for coating components with hard alloy compounds, such as nitrides and carbides of titanium, tungsten and boron. Methods have been designed for reinforcing machine parts most vulnerable to wear and tear, such as in grain harvesters, to make them last several times longer.

Thus, it is not merely quantity engineers and scientists are after, rather it is a matter of major characteristics. In other words, this is a matter of quality, and not of the mere number of new machines, apparatus and materials.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Назовите значения следующих интернациональных слов.

module, robot, to identify, manipulator, electrophysical, electrochemical, unique, rotor, line, productivity, to reserve, criteria, to optimize, vacuum, plasma, component, nitride, carbide, titanium, apparatus

II. Найдите в тексте эквиваленты для русских словосочетаний.

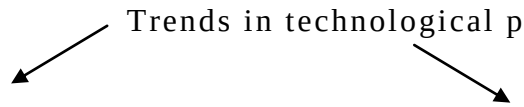
срок службы, передовые методы, электрофизическая обработка, модуль станка, система проектирования, составы из твердых сплавов, методы вакуумной плазмы, упрочение деталей машин, гибкое производство, полностью автоматизированное производство

III. Определите, какие из данных высказываний соответствуют содержанию текста.

1. There are two main trends in modern machine-building: automation and raising of the reliability of machines. 2. The creation of ‘unmanned’ industries is included into automation. 3. Machine modules and robots are not suited for ‘unmanned’ industries. 4. Automation and raising of the reliability of machines

require new technologies. 5. Advanced technologies are applied in most branches of engineering. 6. The service life of machine parts can't be increased by strengthening treatment. 7. Hard alloy compounds are employed for coating components. 8. The process of designing can also be automated. This gives the advantage of optimizing solutions in design and technology.

IV. **Найдите в тексте абзацы, соответствующие положениям схемы. Дополните диаграмму, если это необходимо.**



a) Automation

1) robots;
2) automatic rotor transfer lines;
3) flexible industries
What else?

b) raising reliability and extending the service life
1) strengthening treatment;
2) reinforcing machine parts;
3) vacuum plasma method
What else?

V. Answer the following questions:

1. Name the main trends in modern machine-building. 2. What does automation include? 3. In what way can automation be achieved? 4. What is the role of new technologies? 5. Give some examples of advanced methods for increasing the service life of machine parts. 6. How can the process of designing be improved? 7. What is the main task of the engineers and scientists developing new machines and technologies?

VI. Подготовьте сообщение по теме "Trends in the modern machine-building industry".

GRAMMAR REVISION
Категория наклонения. (The Category of Mood)

Изъявительное наклонение	**Сослагательное наклонение**
1. Значение: выражает действие как реальный факт в настоящем, прошедшем или будущем. 2. Форма: Shall(will), can, may +V I **will be** glad to meet him again.	1. Значение: выражает предполагаемое, возможное или желательное действие. 2. Форма: should (would), could, might +V I **would be** glad to meet him again.

Условные предложения

Изъявительное наклонение	**Сослагательное наклонение**
1. Настоящее время: If she **is asked** to come she always **comes**. 2. Будущее время: If this problem **is** less important, it **will not be discussed.**	1. Настоящее, будущее время: If she **were asked** to come, she **would** always **come**. If this problem **were** less important, it **would not be discussed**.

3. Прошедшее время: If I **had** free time yesterday, I **spent** it on reading.	2. Прошедшее время: If I **had had** free time yesterday, I **would have spent** it on reading.

I. Определите, в каких из следующих предложений употреблено сослагательное наклонение.

1. These castings could not be used because of their defects. 2. If a device transmits force into motion it is called a machine. If a device transmitted force into motion it would be called a machine. 3. If we were pulling a rubber band and then stopped pulling it, the rubber band would quickly return to its original shape and size. 4. We know that we should return soon. 5. If defective castings were brought in for analysis of their defects yesterday, they were tested. 6. If defective castings were brought in for analysis, they would be tested. 7. If there are any changes, the laboratory technician will know. 8. I should have been glad if he had come here yesterday. 9. They would like to see the world's longest bus. 10. If the new equipment had been delivered in time yesterday, there would have been no problem at all.

II. Раскройте скобки и поставьте глагол в нужную форму.

1. If they (to use) another method, the results would have been different. 2. If the complete list of details had been prepared, the engineer (to buy) everything in time. 3. If the load (to increase), the speed would decrease. 4. If all the people of the world (to count) the atoms in a drop of water, they would not be able to finish their work even in ten thousand years. 5. If one knows the dimensions of the body, he (to calculate) easily its volume. 6. If every star in the sky were to shine with the same degree of brightness, the distance to any star (can) readily be established. 7. If he (to know) the specific heat and the weight of the substance, he would have calculated its thermal capacity. 8. If you rubbed the stick, it (to become) warm.

Text 4. INDUSTRIAL ENGINEERING AND AUTOMATION

Задание. Прочитайте и переведите текст.

A major advance in twentieth century manufacturing was the development of mass production techniques. Mass production refers to manufacturing processes in which an assembly line, usually a conveyer belt, moves the product to stations where each worker performs a limited number of operations until the product is assembled. In the automobile assembly plant such systems have reached a highly-developed form. A complex system of conveyer belts and chain drives moves car parts to workers who perform the thousands of necessary assembling tasks.

Mass production increases efficiency and productivity to a point beyond which the monotony of repeating an operation over and over slows down the workers. Many ways have been tried to increase productivity on assembly lines: some of them are as superficial as piping music into the plant or painting the industrial apparatus in bright colors; others entail giving workers more variety in their tasks and more responsibility for the product.

These human factors are important considerations for industrial engineers who must try to balance an efficient system of manufacturing with the complex needs of workers.

Another factor for the industrial engineer to consider is whether each manufacturing process can be automated in whole or in part. Automation is a word coined in the 1940s to describe processes by which machines do tasks previously performed by people. The word was new but the idea was not. We know of the advance in the development of steam engines that produced automatic valves. Long before that, during the Middle Ages, windmills had been made to turn by taking advantage of changes in the wind by means of devices that worked automatically.

Automation was first applied to industry in continuous-process manufacturing such as refining petroleum, making petrochemicals, and refining steel. A later development was computer-controlled automation of assembly line manufacturing, especially those in which quality control was an important factor.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Переведите следующие слова и словосочетания. Если нужно, проконсультируйтесь со словарем.

production, belt, line, process, manufacturing, automation, mass production, conveyer belt, assembly line, industrial engineer, manufacturing process, continuous-process manufacturing, assembly line manufacturing, computer-controlled automation, productivity, efficiency, operation, advance, petrochemicals, steel refining, petroleum refining

II. Ответьте на вопросы.

1. What is a major development in manufacturing in the twentieth century? 2. How is mass production often exemplified by the assembly of automobiles? 3. Discuss efficiency and productivity in mass production. 4. Describe some experiments to increase productivity on assembly lines. 5. When and why was the word ‘automation’ coined? 6.give some examples of automation that were in use before the word itself was created. 7. To what kinds of industries was automation first applied? 8. What was a later development in industrial automation?

III. Приготовьте сообщение на данные темы.

1. Характерные черты массового производства.
Mass production - manufacturing process (in which) - …… (where) ……
2. Сборочный конвейер на автомобильном заводе.
Automobile assembly plant - ……(which)- …… (who) ……
3. Способы увеличения производительности конвейера.
ways to increase productivity are – 1) …… , 2) …… , 3) ……
4. Внедрение автоматизации в производство.
The Middle Ages ⟶ ……
…… ⟶ steam engine
…… ⟶ continuous-process manufacturing

GRAMMAR REVISION
Инфинитив (The Infinitive)

Форма	*Active*	*Passive*
Indefinite	to write	to be written
Continuous	to be writing	---------
Perfect	to have written	to have been written
Perfect Continuous	to have been writing	---------
Употребление	**Функции**	
1. в позиции сущ.: а) перед глаголом; б) после глагола-связки; в) в после глагола 2. в позиции прилаг. 3. в позиции наречия	1. a) **To study** is important. (подлежащее) b)Our aim is **to study**. (именная часть сказ.) c) He began **to study** at school. (часть составного глагольного сказ.) 2. He has the chance **to study** well. (определение) 3. He went to London **to study** there. (обстоятельство)	

I. Переведите следующие предложения. Определите форму и функцию инфинитива.

1. To train highly qualified scientific workers is extremely important for the development of modern science. 2. They hoped to be sent to the conference. 3. The process to be analyzed in this article is known as ionization. 4. To increase the productivity of the machine-tool one should know the characteristics of the material which is machined. 5. The engineer was asked to design a transistor device which will regulate the temperature in the laboratory. 6. In order to break this glass a great amount of force must be applied. 7. To study this phenomenon requires much knowledge. 8. Our plant produces automatic and semiautomatic machine-tools to be installed in new large shops. 9. The same element may combine in different proportions to give different compounds. 10. The problem to find a more economical way of production was solved. 11. This method is accurate enough to give reliable results. 12. Professor Smith was the last to leave the laboratory.

Text 5.

Задание. Прочитайте и переведите текст.

We now use the term ***automation*** for specific techniques combined to operate automatically in a complete system. These techniques are possible because of electronic devices, most of which have come into use in the last thirty years. They include program, action, sensing or feedback, decision, and control elements as components of a complete system.

The program elements determine what the system does and the step-by-step manner in which it works to produce the desired result. A program is a step-by-step sequence that breaks a task into its individual parts. Some steps in an industrial automation program direct other parts of the system when and how to carry out their jobs.

The action elements are those which do the actual work. They may carry or convey materials to specific places at specific times or they may perform operations on the materials. The term ***mechanical handling device*** is also used

for the action elements.

Perhaps the most important part of an automated system is sensing or feedback. Sensing devices automatically check on parts of the manufacturing process such as the thickness of a sheet of steel or paper. This is called feedback because the instruments return or feed back this information to the central system control.

The decision element is used to compare what is going on in the system with what should be going on, it receives information from the sensing devices and makes decisions necessary to maintain the system correctly. If some action is necessary the decision element can give instructions or commands to the system.

The control element consists of devices to carry out the commands of the decision element. There may be many kinds of devices: valves that open or close, switches that control the flow of electricity, or regulators that change the voltage in various machines; they make the necessary corrections or adjustments to keep the system in conformity with its program.

An industrial engineer working with automated systems is part of a team. Many components of the system, such as computers, are electronic devices so electronic engineers and technicians are also involved.

Many of the industries in which automation has proved particularly suitable – chemicals, papermaking, metals processing – involve chemical processes, so there may be chemical engineers at work too. An industrial engineer with expertise in all these fields may become a systems engineer for automation projects thereby coordinating the activities of all the members of the team.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Ответьте на следующие вопросы.

1. What are some elements of an automated system? What makes them possible? 2. What is a program? What does it do in an automated system? 3. Name two terms used to describe the elements which do the actual work. What are some jobs these elements may do? 4. What are some of the things sensing devices do? 5. How do sensing devices act on the information they receive? Why is the process sometimes called feedback? 6. What is the function of the decision element? What can it do? 7. What does the control element consist of? What can these devices do? What is their purpose?

II. Заполните пропуски в следующем тексте, выбрав один из предложенных вариантов.

MECHANICAL ENGINEERING AND MACHINE-BUILDING

Mechanical engineering is concerned with mechanisms, … (*gases, machines, air*) and energy conversions and covers all manners of energy utilization with minimum pollution of the environment. It covers transport, machines and … (*bridge, manufacturing, engine*) processes and the efficient use of mechanisms without excessive vibration and stresses. It covers materials and measurement and the processes of … (*robot, welding, strengthening*) treatment, and … (*reinforcing, tracing, raising*) of the machine

parts. All these aspects are connected with design, automation and … (*motor, automation, advanced*) technology.

The main branches of industry in Nizhny Novgorod are machine-building and metal … (*performing, processing, identifying*) followed by chemical and oil refining industry. Machine-tool building and metal working industries are focused on metalware and tool products for machine-building industries as well as on production of consumer goods and tools. The leading part in the machine-building belongs to the plant … (*increasing, producing, moving*) milling machines equipped with microprocessors. The policy of machine-building industry is aimed at raising … *(reliability, workpiece, monotony*) of the production, extending the service … *(work, development, life*) of parts, increasing … (*productivity, machine-tool, control*).

GRAMMAR REVISION
INFINITIVE CONSTRUCTIONS (Инфинитивные обороты)

I. Complex Object.

подлежащее + сказуемое (Active) + дополнение + инфинитив

дают главное предложение — переводятся подлежащим и сказуемым придаточного предложения

e.g. We expect ***the scientist to be involved*** in the work.
- Мы предполагаем, что этого ученого привлекут к этой работе.

Experience shows ***this strategy to have produced*** better results than more traditional algorithms.
– Опыт показывает, что эта стратегия приводила к лучшим результатам, чем традиционные алгоритмы.

We saw ***concrete parts be prefabricated*** at the works.
– Мы видели, что цементные части заранее изготавливались на заводе.

People make ***systems work***.
– Люди заставляют системы работать.

II. Complex Subject.

подлежащее + сказуемое (обычно Passive) + инфинитив

становится подлежащим — выносится вперед, образует главное предложение — становится сказуемым

придаточного предложения

e.g. ***The lifetime of the equipment*** is assumed ***to be*** 30 years.
– Предполагается, что срок службы такого оборудования составляет 30 лет.

The method is reported ***to have given*** good results.
- Сообщается, что этот метод дал хорошие результаты.

The real situation is likely ***to be very complex***.
- Вероятно, реальная ситуация является очень сложной.

III. Оборот “for + существительное + инфинитив”.

e.g. There is a tendency ***for the method to be used*** in all the experiments.
- Существует тенденция к тому, чтобы использовать этот метод во всех экспериментах.

Задание. Переведите следующие предложения. Определите тип инфинитивной конструкции.

1. We made this reaction run at reduced pressure. 2. The conditions seem to have been poorly chosen. 3. It is possible for the computers to handle all types of information. 4. Work on the iron stabilized material does not seem to have been reported. 5. The rate constant does not appear to be much affected. 6. These variations were found to make little difference in the results. 7. The great heat made the engineer utilize other working conditions. 8. Light and radio waves are said to be of similar nature. 9. These chemical changes appear to have been caused by heat. 10. The technician felt something heavy strike the platform. 11. A high energy of activation is necessary for the reaction to proceed. 12. Mobile atomic power stations are certain to be developed and maintained in our country. 13. The laboratory assistant expects the devices to have been repaired some days ago. 14. We know him to have worked out a new method of applying quantum generators in medicine. 15. The capacity of this aggregate proves to be increasing by and by from its starting. 16. Nearly a month is required for the Moon to circle the Earth. 17. These experiments are likely to have been made in suitable conditions. 18. The discovery of a laser is sure to be of great value. 19. This is a good possibility for us to utilize the electronic equipment for speeding up the process of calculation. 20. The application of this device is unlikely to give better results.

UNIT V. ENGINEERING MATERIALS

Text 1. Engineering Materials

Задание. Прочитайте текст и скажите:
а) в каком абзаце говорится о подразделении всех металлов на два типа;
б) о каких металлах упоминается в тексте.

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

Plastics and ceramics are non-metals; however, plastics may be machined like metals. Plastics are classified into two types – thermoplastics

and thermosets. Thermoplastics can be shaped and reshaped by heat and pressure but thermosets cannot be reshaped because they undergo chemical changes as they harden. Ceramics are often employed by engineers when materials which can withstand high temperatures are needed.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Соедините пары предложений, используя: however - однако, therefore - следовательно, because – так как. Следуйте образцам.

MODEL 1. (a) Copper does not rust.
(b) Copper corrodes. – Copper does not rust; however it corrodes.
MODEL 2. (a) Cast iron is a brittle metal.
(b) Cast iron is not used to withstand impact loads. – Cast iron is a brittle metal, therefore it is not used to withstand impact loads.
MODEL 3. (a) Titanium is used for aircraft frames.
(b) Titanium is light and strong. – Titanium is used for aircraft frames because it is light and strong.

1. Chromium resists corrosion. Chromium is added to steels to make them rust-proof. 2. Manganese steel is very hard. Manganese steel is used for armour plate. 3. Bronze has a low coefficient of friction. Bronze is used to make bearings. 4. Nylon is used to make fibres and gears. Nylon is tough and has a low coefficient of friction. 5. Tin is used to coat other metals to protect them. Tin resists corrosion. 6. Tin is expensive. The coats of tin applied to other metals are very thin. 7. Stainless steels require little maintenance and have a high strength. Stainless steels are expensive and difficult to machine at high speeds. 8. Nickel, cobalt and chromium improve the properties of metals. Nickel, cobalt and chromium are added to steels.

II. Соедините следующие предложения, используя предложенные слова:

MODEL:
because/and/however: Plastics are used widely in engineering. They are cheap. They have a resistance to atmospheric corrosion. Plastics are not particularly strong.
– Plastics are widely used in engineering ***because*** they are cheap ***and*** have a resistance to atmospheric corrosion; ***however,*** they are not particularly strong.

***and*:** There are two types of plastics. Thermoplastics are plastics. Thermosets are plastics.

and/whereas/and: Thermoplastics will soften when heated. Thermoplastics will harden when cooled. Thermosets set on heating. Thermosets will not remelt.

from/to: Plastics are used to make a great variety of products. Plastics are used to make textiles. Plastics are used to make engineering components.

such as: Plastics are available in many forms. Plastics are available in the form of sheets, tubes, rods, moulding powders and resins.

to:	Various methods are used. These methods convert raw plastic into finished products.
when/and:	The chemical changes have taken place. The mould is opened. The molding is extracted.
***by*:**	plastic bowls are made. The compression moulding method is used.
with/which:	The equipment consists of a press. The press has two heated platens. The two heated platens carry an upper and a lower mould.

III. Запомните значение следующих полусуффиксов:

- ***tight*** – характеризует качество соединения
- ***proof, - resistant*** – характеризует свойства материалов

e.g. an ***air-tight*** connection – a connection which air cannot pass through
a ***heat-resistant*** material – a material which is not damaged by heat
a ***moisture-proof*** coating – a coating which moisture cannot pass
an ***acid-proof*** cement – a cement which is not damaged by acid

Переведите следующие словосочетания:

a gas-tight seal, an oil-proof cement, a water-resistant coating, a water-tight connection, a sound-proof engine cladding, a rust-proof surface, a shock-proof mounting, a corrosion-resistant steel, a weather-proof surface

GRAMMAR REVISION
PARTICIPLE (Причастие)

Значение	**Форма**	
Причастие	**Active Voice**	**Passive Voice**
Participle I (Indefinite) Действие, одновременное с действием сказуемого предложения	**V1-ing** – using a) использующий, использовавший (определение) b) используя (обстоятельство)	**being +V3** – being used a)используемый, использующийся, который используется (определение) b) будучи использован, когда (его) использовали (обстоятельство)
Participle I (Perfect) – Действие, предшествующее действию сказуемого предложения	**having+V3 –** having used использовав, когда (он) использовал (обстоят.)	**having been+V3 –** having been used когда (его) использовали (обстоятельство)
Participle II	----------	**V3 –** used a) используемый, использованный (определение) b) когда (его) использовали (обстоятельство)

Задание. Переведите следующие предложения на русский язык. Определите форму и функцию причастия.

1. We were demonstrated an operating system. 2. Designing new systems we can use electronic computers. 3. Having finished the experiment the engineers

started a series of new tests. 4. A barometer is an instrument measuring atmospheric pressure. 5. Metals being used in industry in the form of alloys have better properties than pure metals. 6. Having made many experiments scientists proved that electricity had an atomic character. 7. Being the cheapest of the metals cast iron is widely used everywhere. 8. A neutron is a particle having the same mass as a proton but carrying no electric charge. 9. An automobile begins its life in the fully mechanized assembly department. 10. The area of the car works built on the Kama river is almost 1000 hectares. 11. The cars are going through special tests called "the Belgian road" and the washboard road. 12. The results obtained were carefully studied. 13. When frozen, water is a colourless solid known as ice. 14. The steering system used has been tested by the research engineers of the safety device laboratory. 15. When assembled the car undergoes various tests. 16. In one of the plants visited, the delegates were shown new types of equipment. 17. Having taken everything into consideration, he decided not to go there. 18. The method used facilitated the procedure. 19. We also discussed experiments connected with some related questions. 20. Written in pencil the article was difficult to read.

Text 2. The Plastic Age.

Задание. Прочитайте и переведите текст.

It's in our homes. It's the most common material in the workplace. Sometimes it's even in our bodies. We may be moving into the Information Age, but it's hard to believe that we are not living in the Plastic Age.

The very name "plastic" means versatility. You can bend it, mold it, model it, twist it and ply it in a number of different ways. The finished product can be a soft and airy foam or a hard and strong compound rivaling the sturdiest metal alloys. In its many forms, plastic has forever changed the way we live.

The first in the long line of man-made plastics was called Bakelite, after its inventor, Leo Baekeland. Many years of work in his chemistry lab in Yonkers, New York, led him in 1907 to the invention of the first synthetic polymer (plastic), made by linking small molecules together to make large ones.

Baekeland made his new material by mixing the carbolic acid (phenol) with the strong-smelling formaldehyde to make a third material that was nothing like the original two. It turned out to be a substance that would change the world.

Some of the early uses for plastic were to make things like radio cabinets, buttons, billiard balls, pipe-stems, toilet seats, airplane parts and, the object of Baekeland's research, shellac (шеллак). Baekeland's trick was to take the resin produced by the two chemicals and heat it under pressure to produce a soft solid that could be molded and hardened or powdered and set under pressure. With this innovation, the plastic revolution was under way.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Просмотрите текст "The Plastic Age" и определите:

а) в каких абзацах описывается технология получения пластмассы;

b) в каком абзаце описываются свойства пластмассы;
c) основные шаги деятельности изобретателя, в честь которого назван бакелит.

II. Подготовьте сообщение на тему "The Substance that changed the world" по плану:
a) properties of plastics;
b) the first man-made plastics;
c) the early uses for plastic.

III. Составьте на английском языке схему получения:
а) бакелита;
б) шеллака:
исходные материалы – процесс - результат – свойства

GRAMMAR REVISION
PARTICIPLE CONSTRUCTIONS (Причастные конструкции)

I. Complex Object.

Подлежащее + сказуемое + дополнение + (as) Participle I (II)

дают главное предложение | перев. подлежащим придаточного предл. | перев. сказуемым придаточного предл.

e.g. I hear ***the bell ringing***. – Я слышу, как звенит звонок.
You must have ***your hair cut***. – Вы должны подстричься.
We consider ***the parameter as utilized*** to limit the number of questions asked. - Мы считаем, что этот параметр используется для ограничения числа задаваемых вопросов.
They thought ***the reaction as being*** of the first order. - Они считали, что реакция была первого порядка.

II. Complex Subject.

Подлежащее + сказуемое + (as) Participle I (II)

Обычно Passive выносится вперед, образует главное предл.

Образуют придаточное предложение

e.g. ***They*** were seen ***crossing*** the street. – Видели, как они переходили улицу.
The dinner was left ***untouched***. – Обед оставили нетронутым.
The problem was recognized by many scientists ***as being*** of great importance. - Многие ученые признали, что эта проблема имеет огромное значение.
The class of regulators can be thought of ***as composed*** of 3 parts. – Можно считать, что этот класс регуляторов состоит из трех частей.

III.Absolute Participle Constructions.

a) Nominative Absolute Participle Construction. (NAPC)

1) если в начале предложения, то в русском языке используются подчинительные союзы – ***так как. когда, если, хотя, после того как***

e.g. ***All the equipment removed***, the explorers stopped working.

- **Когда** все оборудование было убрано, исследователи прекратили работу.

The other conditions being equal, the acceleration will be the same.

- **Если** все остальные условия будут равны, ускорение будет одним и тем же.

2) если в конце предложения, то перед придаточным употребляются союзы – ***причем, а, и***

e.g. We carried out a series of reactions, ***the raw materials brought from their laboratory***.

- Мы провели серию реакций, **причем** исходные материалы были взяты из их лаборатории.

b) Prepositional Absolute Participle Construction.(PAPC)

Вводится служебным словом ***with,*** запятая может отсутствовать.

e.g. ***With water being cooled,*** the rate of the reaction was low.

- **Когда (если)** воду охлаждали, скорость реакции была низкой. Performance observations were recognized, ***with particular attention being on the variables***.

- Наблюдения за работой механизма регистрировались, **причем** особое внимание уделялось переменным величинам.

Задание. Переведите предложения на русский язык, обращая внимание на причастные обороты.

1. I want the letter posted at once. 2. The situation being favourable, they bought the shares. 3. I have just had the newest version installed. 4. The conference being over, the delegates made a tour of the country. 5. You must have your new TV set regulated. 6. Personal computers being widely used, their characteristics are improved. 7. I had my watch repaired. 8. They were seen leaving the laboratory. 9. We have the program debugged. 10. The evaporation increases the temperature, other things being equal. 11. Some scientists do not distinguish between pure and applied mathematics, the distinction being, in fact, of recent origin. 12. There are several branches of the metal working industry, foundry being one of the most important ones. 13. All factors considered, we believe that the mechanism is the most likely. 14. We have already mentioned this method affording good results. 15. The temperature being raised, the kinetic energy is increased. 16. He had our research group presented at the last symposium. 17. With the question of representing information settled, the major design question becomes one of logic operations. 18. This phenomenon is postulated as having arisen from excessive heating. 19. A new technique having been worked out, the yields rose. 20. The first metals used by men were gold, silver and copper, these metals being found free in nature or metallic state.

Text 3. New Steels Meet Changing Needs.

Задание. Прочитайте и переведите текст.

As a structural material steel has two drawbacks: its weight and its susceptibility to rust. However, due to its advantages, steel has long been used, and in great quantities, in structural applications from bridges and buildings to ships, automobiles and household appliances. Steel is superior to other structural materials in strength, toughness, workability and other properties that are critical for such applications, and it is mass-produced with uniform, reliable quality and at a low cost.

Since steel is the most popular structural material available, steel-makers make every effort to meet the changing needs of these markets. New, more sophisticated processes for steel-making and treatment have led to steel products of higher grade and a greater variety.

Yet, it can no longer be said that a steel product is satisfactory if it is simply a good structural material. Today's market needs can be classified broadly as: 1) the need for lighter weight; 2) the need for new properties; 3) the need for maximum performance; and 4) the need for cost reduction.

The need for lighter weight is really a requirement for materials having higher specific strength (strength/specific gravity). Materials offering new properties not found in conventional materials will include new breeds of steel, hybrid materials and truly novel materials such as amorphous metal. The need for maximum performance calls for materials approaching the limits of durability, toughness and the like. Finally, the need to reduce costs is leading to materials diversification in which steel materials precisely suited to a specific application are developed. New families of steel products are steadily emerging to meet these needs.

Let's look now at how steel needs have changed in automotive industry and how steelmakers have met these needs.

What is needed in new steels by automotive industry.

Changes in auto industry's environment	New requirements for steel by auto industry	Steels which meet auto industry's requirements
Fuel efficiency Durability Exhaust gas restriction Noise restriction Safety requirements	Weight reduction, lighter gauge of steel Corrosion resistance Heat resistance Noise reduction Rigid structure	High-strength sheets with good formability (dual-phase steel) Coated sheets (one-side galvanized sheets) Heat-resistant stainless sheets, aluminized sheets Vibration-damping sheets High-strength low-alloy steel

Some properties of metals.

Every engineering material possesses material certain properties, or characteristics or qualities which we can find by experiment; these properties may make the material suitable or unsuitable for any particular purpose. Here are some of the properties which metals may have.

Property				**Definition**
The metal is	fluid	It has	fluidity	It flows easily when it melts.
	plastic		plasticity	It pulls out of shape without breaking.
	elastic		elasticity	It always returns to its original shape.
	ductile		ductility	It can be stretched without breaking.
	malleable		malleability	It can be hammered out of shape without breaking.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Переведите следующие слова и словосочетания. Если нужно, проконсультируйтесь со словарем.

structural material, application, critical properties, uniform properties, popular material, steel product, to classify, specific strength, hybrid material, specific application, automotive industry, toughness, durability, workability, amorphous metal, structural application, to meet the needs of the markets

II. Выпишите из первого абзаца английские слова и словосочетания, выражающие понятия, связанные с недостатками современных сталей и с их преимуществами.

Steel has

drawbacks and advantages

1)… 2) … 1) … 2) … 3) … 4) … 5) …

III. a) Выпишите из третьего абзаца текста словосочетания, выражающие требования к конструкционным сталям на современном этапе.

b) Найдите в четвертом абзаце и выпишите параметры (словосочетания), отвечающие этим требованиям.

1) need for lighter weight → highest specific strength
2) … →
3) … →
4) … →

IV. Ответьте на следующие вопросы.

1. What are the two drawbacks of modern steel materials? 2. What are the advantages of steel over other metals? 3. In what fields of engineering has steel been long used? 4. What are the modern needs for steel development? 5. How could these needs be met? 6. How have modern steel needs changed in automotive industry?

V. Приготовьте сообщения на следующие темы;
а) Достоинства и недостатки современных конструкционных сталей.
б) Требования к современным конструкционным сталям.
в) Тенденции в современном развитии сталей.
г) Тенденции в развитии сталей в автомобилестроении.

GRAMMAR REVISION
GERUND (Герундий)

Значение	**Форма**	
Герундий	Активный залог	Пассивный залог
Gerund Indefinite – действие, одновременное с действием сказуемого	V1-ing – using	being+V3 – being used
Gerund Perfect – действие, предшествующее действию сказуемого	having+V3– having used	having been +V3 – having been used
Употребление	**Функция**	
1. в позиции существительн.: а) перед глаголом; б) после глагола без предлога; в) после глагола с предлогом; г) после глагола-связки 2. в позиции прилагательного 3. в позиции наречия	1. a) *Reading* is my hobby. (подлежащее) b) I like *reading*. (прямое дополнение) c) I am fond of *reading*. (предложное дополнение) d) My hobby is *reading*. (именная часть сказуемого) 2.There are different ways of *reading*. (определение) 3. After *reading* the book he went to bed. (обстоятельство)	
Способы перевода	**Примеры**	
1)существительное; 1) инфинитив; 2) деепричастие; 3) придаточное предложение	1) *Reading* is useful. – *Чтение* – полезно. 2) He finished *reading* this book. – Он закончил *читать* эту книгу. 3) *After reading* this book he gave it to me. – *Прочитав* эту книгу, он дал ее мне. 4) I thanked him for *giving* me this book. – Я поблагодарил его за *то, что он дал мне эту книгу*.	

I. Переведите следующие предложения.

1. Casting is a process of forming metal objects. 2. The open-hearth process is one of the most important methods of making steel. 3. Numerous methods have been developed for producing metal castings. 4. The test needed increasing the

temperature of the molten metal. 5. There are some ways of obtaining high quality alloys. 6. After pouring, the molten metal is allowed to solidify in a mold. 7. Aluminium has a melting point of 658,7°C. 8. You cannot make an omelet without breaking eggs.

II. **Переведите группы слов и предложения. Обратите внимание на употребление предлогов перед герундием**:

in - при; **on(upon)** – по, после; **by** – путем, посредством, при помощи; **without** - без

in building, in melting, on heating, on completing, on melting, by introducing, without employing, without machining

1. In building new metallurgical works, engineers have to solve many different problems. 2. In melting steel, foundrymen use electric furnaces, crucible furnaces and converters. 3. Liquids and gases expand on heating. 4. On completing the construction, the cupola was tested in operation. 5. Casting is a process of forming metal objects by melting metal and pouring it into molds. 6. By introducing new foundry methods the engineers improve the quality of castings and the speed of manufacture. 7. High-grade castings cannot be produced without employing electric furnaces. 8. Most castings cannot be employed as parts of complex mechanisms without machining and finishing.

Text 4. Non-Ferrous Metals.

Задание. Прочитайте и переведите текст.

Although ferrous alloys are specified for more engineering applications than all non-ferrous metals combined, the large family of non-ferrous metals offers a wider variety of characteristics and mechanical properties. Foe example, the lightest metal is lithium, 0.53 g/cm^3, the heaviest, osmium, weighs 22.5 g/cm^3 – nearly twice the weight of lead. Mercury melts at around -38°F, and tungsten, the metal with the highest melting point, liquefies at 6,170°F. Availability, abundance, and the cost of converting the metal into useful forms – all play important parts in selecting a non-ferrous metal. One ton of earth contains about 81,000g of the most abundant metal of land, aluminium. One ton of sea water, on the other hand, contains more magnesium than any other metal (about 1,272g).

All sources combined, magnesium is the most abundant metal on earth. But because magnesium is difficult to convert to a useful metal, it may cost several times that of the least expensive and most easily produced metal, iron billet. Although nearly 80% of all elements are called “metals”, only about two dozen of these are used as structural engineering materials. Of the balance, however, many are used as coatings, in electronic devices, as nuclear materials, and as minor constituents in other systems.

Aluminium

Aluminium is lightweight, strong and readily formable. Aluminium and its alloys, numbering in the hundreds, are available in all common commercial

forms. Because of their high thermal conductivity, many aluminium alloys are used as electrical conductors. Commercially pure aluminium has a tensile strength of about 13,000 psi. Cold-working the metal approximately doubles its strength. For greater strength aluminium is alloyed with other elements such as manganese, silicon, copper, magnesium or zink. Some alloys are further strengthened and hardened by heat treatments. Most aluminium alloys lose strength at elevated temperatures, although some retain significant strength to 500°F.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Ответьте на следующие вопросы.

1. Which of the non-ferrous metals is the most abundant metal of the Earth? 2. Which is the most abundant metal of land? 3. What factors define the selection of materials? 4. Why is magnesium so expensive? 5. Name the properties of pure aluminium. 6. How are the properties of pure aluminium improved?

II. Выпишите свойства различных материалов, упоминаемых в тексте.

Материалы		Свойства				
Англ. яз.	Рус	Specific weight	strength	abundan-ce	melting point	conductivity
Lithium		0.53 g/cm^3	-	--------		
Osmium		22.5 g/cm^3	-	--------		
Mercury		-	-	--------	+	
Tungsten		-	-	--------	+	-
Aluminium		+	+	--------	-	+
Magnesium		-	-	most abundant	-	-

GRAMMAR REVISION
Герундиальный оборот.

I insist on **his doing** the work. - Я настаиваю, чтобы он сделал эту работу.
I insist on **Mr Black's doing** the work. - Я настаиваю, чтобы мистер Блэк сделал эту работу.
I insist on **his firm doing** the work. - Я настаиваю, чтобы его фирма сделала эту работу.

I. Найдите герундиальные обороты и переведите предложения.

1. We know of Newton's having developed principles of mechanics. 2. Mankind is interested in atomic energy being used only for peaceful purposes. 3. We know of Russian metallurgical industry having made a great progress. 4. We speak about cupolas being used for melting cast iron. 5. Great attention is paid to the metal being heated to the proper temperature. 6. That sand molds are the oldest method for producing metal castings is a well-known fact. 7. There is no hope of our getting a complete analysis of this measurements within 10 days. 8. They insisted on the sample being tested

repeatedly. 9. His having made the experiment is a known fact. 10. They objected to our using greater voltage in this case. 11. We know of the work being carried out in his laboratory. 12. They know of the experiment having been carried out in his lab.

II. Переведите предложения на русский язык. Назовите формы и функции герундия в предложении.

1.Melting may be done in cupolas, air furnaces, electric furnaces, etc. 2. Some metals require treatment before being placed in the melting furnace. 3. Carrying molten metal is usually performed in crane ladles. 4. The most favourable characteristic of a sand casting is its retaining good strength at moderately elevated temperature. 5. Melting is very important in the production of high-quality castings. 6. We know of electric furnaces being used for the production of high-grade castings. 7. A foundry cannot operate without employing proper foundry materials. 8. It is worth while discussing this phenomenon. 9. Defining problems precisely requires patience. 10. Operating conditions differed widely. 11. We were all for starting the experience at once. 12. They couldn't help seeing the importance of the process.

Text 5. Plastics.

Задание. Прочитайте и переведите текст.

Plastics are a large and a varied group of materials consisting of combinations of carbon and oxygen, hydrogen, nitrogen, and other organic and inorganic elements. While solid in its finished state, a plastic is at some stage in its manufacture, liquid and capable of being formed into various shapes. Forming is most usually done through the application, either singly or together. There are over 40 different families of plastics in commercial use today, and each may have dozens of subtypes and variations.

A successful design in plastics is always a compromise among highest performance, attractive appearance, efficient production, and lowest cost. Achieving the best compromise requires satisfying the mechanical requirements of the part, utilizing the most economical resin or compound that will perform satisfactorily, and choosing a manufacturing process compatible with the part design and material choice.

Most people have now outgrown the impression that plastics are low-cost substitute materials. Those that still view plastics as cheap and unreliable have not kept up with developments in polymer technology for the past ten years.

Many plastics did indeed evolve as replacements for natural products such as rubber, ivory, silk or wool, which became unavailable or on short supply. But the new materials did not necessarily replace the older ones permanently nor made them obsolete. In many cases, they met an increased demand that could not be met by the natural product alone. Today's engineering resins and compounds serve in the most demanding environments. Their toughness, lightness, strength, and corrosion resistance have won many significant applications for these materials in transportation, industrial and consumer products. The engineering plastics are now challenging the domains traditionally held by metals: truly load-bearing, structural parts.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Переведите следующие слова и словосочетания на русский язык.

group, combination, organic element, inorganic element, finished state, forming, commercial use, compromise, efficient production, mechanical requirement, substitute material, natural product, transportation, structural part, carbon, oxygen, hydrogen, nitrogen, corrosion resistance, pressure, to satisfy requirement, to meet demands, to outgrow, to keep up, solid, liquid

II. В каком абзаце описаны:
а) требования к пластмассам;
б) характеристики и применения пластмасс;
в) определение понятия «пластмасса» и способы ее получения;
г) различные взгляды на возможности применения пластмасс и подтверждение (опровержение) этих взглядов (два абзаца).

III. Выпишите из текста словосочетания, выражающие понятия, которые определяют требования к конструкции изделий из пластмасс, а также словосочетания, определяющие способы удовлетворения этих требований.

1. highest performance ⟶ mechanical requirements of the part
   высшие характеристики ⟶ механические свойства детали
2. ……
3. ……
4. ……

GRAMMAR REVISION.
Сопоставление причастия I, отглагольного существительного и герундия.

<u>Отглагольное существительное:</u> ***The solving of*** the problem was approved.

Употребление в позиции	**Gerund**	**Participle I**
1. Существительного а) перед глаголом (подлежащее)	*Melting* is performed in melting furnaces.	-
б) после глагола-связки (именная часть сказуем.)	The best way to solve this problem is *experimenting*.	-
в) после глагола (дополнение)	The foundrymen completed *melting* in time.	-
2. глагола (сказуемое)	-	The engineer is *preparing* a series of experiments.
3. прилагательного (определение)	The principle of *operating* this mechanism is simple.	We were demonstrated an *operating* furnace.
4. наречия (обстоятельство)	After *being subjected* to all tests the machine was stopped.	*Having been subjected* to all tests the machine was stopped.

I. Определите, являются ли ing-формы причастием, герундием или отглагольным существительным.

1. Heating the gas increases the speed of the molecules. 2. Having made the experiment, the research engineer recorded the data. 3. Translating from language to another we can use electronic computers. 4. Translating from one language to another has been accomplished by an automatic computer. 5. The failure was due to the operator's having been careless in using the instrument. 6. The cupola is the most generally used melting process for cast iron, the fuel economy being highest and ease of manipulation greatest. 7. The Bessemer converter is used in steel making. 8. Cupola melting is continuos. 9. All non-ferrous alloys having a lower melting temperature than iron alloys are melted in crucible furnaces, open-flame furnaces and electric furnaces. 10. The theory also basically improves understanding of a queuing situation enabling better control. 11. Before starting the engine it is necessary to test the piping for leakage. 12. This procedure is finding increasing use.

II. Определите, как переводятся ing-формы в следующих предложениях:

1.There are specialized institutes ***training*** engineers, doctors, teachers.
a) обучающие; b) обучение
2. A student must accumulate large amounts of new information which is ***growing*** all the time.
a) растет; b) рост; c) растущая
3. An engineering solution to a problem involves ***making an analysis*** of the problem.
a) анализируя; b) анализ; c) анализирующий
4. The courses of study include electronic and electrical ***engineering***, economics and mathematics.
a) технический; b) техника
5. The ***teaching*** on the courses is organized by lectures, seminars and tutorials.
a) обучающий; b) обучение; c) обучая
6. ***Reading*** technical journals is important for every engineer.
a) читая; b) прочитав; c) чтение
7. We learn much by ***reading*** special technical literature.
a) прочитав; b) читая
8. After ***reading*** this article he made an interesting report.
a) прочитав; b) читая; c) чтение

Text 6. Fibers.

Задание. Прочитайте и переведите текст.

Fibers are probably the oldest engineering materials used by man. Jute, flax, and hemp have been used for "engineering" products such as rope, cordage, nets, water hose, and containers since antiquity. Other plant and animal fibers have been used for felts, paper, brushes, and heavy structural cloth. The fiber industry is clearly divided between natural fibers (from plant, animal, or mineral sources) and synthetic fibers. Many synthetic fibers have

been developed specifically to replace natural fibers, because synthetics often behave more predictably and are usually more uniform in size.

For engineering purposes, glass, metallic and organically derived synthetic fibers are most significant. Nylon, for example, is used for belting, nets, hose, rope, parachutes, webbing, ballistic cloths, and as reinforcement in tyres.

Metal fibers are used in high-strength, high-temperature, light-weight composite materials for aerospace applications. Fibers composites improve the strength-to-weight ratio of base materials such as titanium and aluminium. Metal-fiber composites are used in turbine compressor blades, heavy-duty bearings, pressure vessels and spacecraft re-entry shields. Boron, carbon, graphite, and refractory oxide fibers are common materials used in high-strength fiber composites.

Glass fibers are probably the most common of all synthetic engineering fibers. These fibers are the finest of all fibers, typically one to four microns in diameter. Glass fibers are used for heat, sound, and electrical insulation; filters; reinforcements for thermoplastics and thermoset resins and for rubber (such as in tyres); fabrics, and fiber optics.

TEXT-BASED ASSIGNMENTS
Language and Text Study

I. Прочитайте текст “Fibers” и скажите:

а) о каких двух группах волокна говорится в нем;

б) в каком абзаце идет речь о видах синтетического волокна;

в) какие два аспекта, связанные со стекловолокном, рассматриваются в последнем абзаце.

III. Заполните следующую таблицу.

Вид волокна		**Свойства**		**Применение**	
metal fiber	----------	fine	тонкий	space	--------
glass fiber	стекловолокно	---------	---------	-------	--------

IV. Основываясь на схему, составьте сообщение по теме “Engineering Materials”.

1. needs: maximum performance; lighter weight; new properties; cost reduction
2. engineering materials: → non-metals → plastics
   ↓ ceramics
   metals
   ↓
   ferrous → non-ferrous
   ↓ ↓
   cast iron steel aluminium copper bronze
3. properties of aluminium – lighteness, strength, good formability
   properties of plastics – toughness, lightness, strength, corrosion resistance

GRAMMAR REVISION.
The Complex Sentence (Сложные предложения)

1. дополнительные придаточные:
   a) I know **what** *the head engineer said*.
   b) I know **when** *he will come*.
2. придаточные-подлежащие:
   a) ***What*** *the head engineer said* is very important.
   b) **When** *he will come* is not known.
   c) **That** *he has made a mistake* is strange.
   d) **Whether** *they will come today* is not known yet.
   e) **It**'s strange **that** *he has made a mistake*.
3. предикативные придаточные:
   a) The question is **what** *the head engineer said.*
   b) The question is **when** *he will come.*
4. определительные придаточные:
   a) I know the engineer **who** *is standing at the door.*
   b) I have seen the house **where** *he lived.*
   c) The reason **why** *he did it* is not known.
5. обстоятельственные придаточные:
   a) ***When*** *we arrived at the port,* the steamer was being loaded with wheat.
   b) I went away **because** *there was no one there*.

I. Определите, какие из приведенных ниже предложений простые, а какие – сложноподчиненные.

1. They also undertake the training of people who want to work at the new plant but do not have the required qualification. 2. The students know how to conduct this experiment. 3. The students know how they have to conduct this experiment. 4. He shows me the results of his work. 5. He shows me what results he has obtained. 6. There is a growing need for engineers who are familiar with the fundamental problems in metal processing and manufacturing. 7. There is a growing need for engineers familiar with the fundamental problems in metal processing and manufacturing. 8. When new types of autos are designed all the latest achievements of scientific and engineering progress are taken into account. 9. When designing new types of autos all the latest achievements of scientific and engineering progress are taken into account.

II. Переведите предложения на русский язык, определив предварительно тип придаточного предложения.

1. At present Moscow has a great number of cars running on liquid gas, which is cheaper than gasoline. 2. The history of civilization shows that transport always was and still remains one of the largest branches in the general system of world economy. 3. As a rule, a mechanic tells you what is wrong with your car. 4. It is expected that in the near future cars with less toxic exhaust gases will be widely used soon. 5. The exploitation of gas-driven cars and scientific experiments show that it is now possible to produce engines operating on gas. 6. The ceramic magnets we use now in electric engineering have replaced the traditional steel pole-piece plus copper field coil. 7. Plastics are used in volumes which have exceeded those of all non-ferrous metals put together. 8. Whether the reinforced plastics will be used in this car depends on the results

of the test. 9. If we obtain good results, the reinforced plastics will be used in this car. 10. That future improvements in productivity largely depend on the application of science to manufacturing is a well-known fact. 11. The achievements of science that are applied to manufacturing increase the productivity in all branches of industry. 12. The advantage of the diesel engine is that it has a higher thermal efficiency. 13. Many young scientists try their hand in research long before they enter postgraduate course. 14. Since the technology of any age is founded upon the materials of the age, the era of new materials will have a profound effect on engineering of the future.

III. Переведите предложения на русский язык, обратив внимание на то, что некоторые придаточные определительные могут присоединяться к главному без союза.

1. Modern physics has discovered a complicated array of fundamental particles of which all matter is composed. – Modern physics has discovered a complicated array of fundamental particles all matter is composed of. 2. There are numerous ways in which industry and education can cooperate on problems of common interest. - There are numerous ways industry and education can cooperate in on problems of common interest. 3. Welding is the most universal way of joining parts. Lasers have already been used for some time for obtaining super-clean welds that chemists need so badly. - Lasers have already been used for some time for obtaining super-clean welds chemists need so badly. 4. The factory which we are speaking about is one of the cleanest in the country. - The factory we are speaking about is one of the cleanest in the country.

Additional Texts

Text 1. CHANGES IN MATERIALS TECHNOLOGY

Since the technology of any age is founded upon the materials of the age, the era of new materials will have a profound effect on engineering of the future. Not only new materials, but related, and equally important, new and improved and less wasteful processes for the shaping, treating and finishing of both traditional and new materials are continuously being developed.

It is important that an engineer should be familiar with them. These include casting, injection molding and rotational molding of components of ever increasing size, complexity and accuracy; manufacture of more complex components by powder metallurgy techniques; steel forming and casting processes based on new, larger and more mechanized machines, giving reduced waste and closer tolerances; the avoidance of waste in forging by the use of powder metallurgy or cast pressforms and new finishing processes for metals and plastics, just to name a few. A high proportion of these processes is aimed at the production of complex, accurate shapes with a much smaller number of operations and with far less waste than the traditional methods of metal manufacture.

Joining techniques have developed to unprecedented level of sophisti-cation and are also providing opportunities for economies. It is necessary to mention that these newer techniques allow the manufacture of complicated parts by welding together simpler sub-units requiring little machining; such

assemblies can be made from a variety of materials. The methods can also be used effectively for assembly, allowing savings to be made in both materials and machine utilization. The brief review of new processes above has indicated that a new materials technology is rapidly emerging, providing new opportunities and challenges for imaginative product design and for more efficient manufacture.

Text 2. METAL-CASTING – A BASIC MANUFACTURING PROCESS

One of the basic processes of the metal-working industry is the production of metal castings. A casting may be defined as “a metal object obtained by allowing molten metal to solidify in a mold”, the shape of the object being determined by the shape of the mold cavity. A foundry is a commercial establishment for producing castings.

Numerous methods have been developed through the ages for producing metal castings but the oldest method is that of making sand castings in the foundry. Primarily, work consists of melting metal in a furnace and pouring it into suitable sand molds where it solidifies and assumes the shape of the mold. Most castings serve as details or component parts of complex machines and products. In most cases they are used only when they are machined and finished to specified manufacturing tolerances providing easy and proper assembly of the product. At present the foundry industry is going through a process of rapid transformation, owing to modern development of new technological methods, new machines and new materials. Because of the fact that casting methods have advanced rapidly owing to the general mechanical progress of recent years there is today no comparison between the quality of castings, the complexity of the patterns produced and the speed of manufacture with the work of a few years ago.

Text 3. THE FUNDAMENTALS OF FORGING

Forging is the oldest known metalworking process. It is believed to have begun when early man discovered he could beat pieces of ore into useful shapes. History tells us that forging was widely practiced at the time when written records first appeared.

The blacksmith was one of the first to realize the advantages of forging. Although he did not know why, he knew that hammering a piece of hot metal not only resulted in a usable shape, it improved its strength. It is this inherent improvement in strength of metal that has placed forgings in the most highly stressed applications in machines.

To understand why forging improves the mechanical properties of metal, it is important to recognize that metal is made up of grains. Each grain is an individual crystal, and when the grains are large, cracks can occur and propagate along the grain boundaries. Therefore, it is desirable to minimize the grain size in a metal.

Reducing the metal's grain size is one of the things forging does so well. Forging breaks down a coarse-grained structure producing a chemically homogeneous wrought structure with much smaller grains by controlled plastic deformation. In forging, controlled plastic deformation whether at elevated

temperature or cold (at room temperature) results in greater metallurgical soundness and improved mechanical properties of the metal.

Metal shaping by controlled plastic deformation is the basis for all forging operations. Because of the diversity of forging applications, however, a wide range of processes and equipment have been developed to produce forgings. Some processes are ideally suited to make large parts, others, small parts, and still others, rings. Modern forging is not only carried out in virtually all metals, it is done at temperatures ranging from more than 2500 F to room temperature. Part configuration generally determines the forging method chosen.

TEXT 4. METAL CUTTING

Cutting is one of the oldest arts practised in the stone age, but the cutting of metals was not found possible until the 18th century, and its detailed study started about a hundred years ago.

Now in every machine-shop you may find many machines for working metal parts, these cutting machines are generally called machine-tools and are extensively used in many branches of engineering. Fundamentally all machine-tools remove metal and can be divided into the following categories: turning machines (lathes), drilling machines, boring machines, milling machines, grinding machines. Machining of large-volume production parts is best accomplished by screw machines. These machines can do turning, threading, facing, boring and many other operations. Machining can produce symmetrical shapes with smooth surfaces and dimensional accuracies not generally attainable by most fabrication methods.

Screw-machined parts are made from bar stock or tubing fed intermittently and automatically through rapidly rotating hollow spindles. The cutting tools are held on turrets and tool slides convenient to the cutting locations. Operations are controlled by cams or linkages that position the work, feed the tools, hold them in position for the proper time, and then retract the tools. Finished pieces are automatically separated from the raw stock and dropped into a container. Bushings, bearings, nuts, bolts, studs, shafts and many other simple and complex shapes are among the thousands of products produced on screw machines. Screw machining is also used to finish shapes produced by other forming and shaping processes. Most materials and their alloys can be machined — some with ease, others with difficulty. Machinability involves three factors: 1. Ease of chip removal. 2. Ease of obtaining a good surface finish. 3. Ease of obtaining good tool life.

Text 5. FACTORS AFFECTING MACHINABILITY

Machinability is generally assumed to be a function of tool edge life. The main factors which influence the behaviour, and thus the life of the edge of a cutting tool, are: - the mechanical characteristics of the material being machined, such as its strength, hardness and metallurgical structure;

- the state of the casting, involving the skin finish, critical dimensions, machining allowances, slag inclusions, the presence of scabs, rust, dirt, etc.;

— the nature of the machining techniques being used;

— the characteristics of the machine-tool being used, such as machine efficiency, available power, and the rigidity of the setup.

Other factors aside, it is primarily the structure of the metal which determines its resistance to the cutting action of the tool, i. e. the potential rate of metal removal, and the resulting abrasion on the tool, i. e. the life of the cutting edge.

Structure, strength and machinability are interrelated to some extent — in general, increased strength implies reduced machinability. This basic relationship must be understood, otherwise difficulties may be experienced in the machine shop if the designer has specified a material with a higher strength than is necessary. Nevertheless, care should be taken in rating machinability on the basis of strength. For example, nodular irons are normally considerably stronger than flake-graphite types, but are likely to be easier to machine. It is therefore recommended that structure, rather than strength, be adopted as the basis for machining practice.

Hardness provides a more reliable guide to machinability than does strength, for hardness depends mainly on the matrix structure of the casting. Again, however, the relation is of a general nature only, for it is possible to have a metal which exhibits a low hardness value, but which has a very abrasive action on the cutting tool. For example, the presence of hard phosphide particles embedded in a soft, ferritic matrix reduces tool life considerably.

Приложение.

I. Engineer - a) инженер; b) (Am.) машинист; c) механик, монтер; d) сапер

1) **advisory engineer** – инженер-консультант
2) **assistant engineer** – младший инженер
3) **automatic-control engineer** – инженер по автоматическим системам управления
4) **automotive engineer** – инженер-автомобилист, инженер по двигателям внутреннего сгорания
5) **building engineer** – инженер-строитель
6) **chief engineer** – главный инженер, главный механик
7) **combustion engineer** – инженер-теплотехник
8) **civil engineer** – инженер-строитель
9) **computer engineer** - инженер по вычислительной технике
10) **design engineer** - конструктор
11) **efficiency engineer** – инженер по рационализации производства
12) **equipment engineer** – инженер по оборудованию
13) **ground engineer** – инженер по эксплуатации
14) **hydraulic engineer** – инженер-гидротехник
15) **industrial engineer** – инженер-технолог, инженер по организации производства
16) **industrial-relations engineer** – инженер по промышленным связям
17) **installation engineer** – инженер-монтажник
18) **management engineer** – ведущий инженер
19) **maintenance engineer** – инженер по ремонту оборудования
20) **marine engineer** – корабельный инженер-механик
21) **mechanical engineer** – инженер-механик, инженер-машиностроитель
22) **metallurgical engineer** – инженер-металлург
23) **methods engineer** – инженер по рационализации методов работы
24) **operation engineer** – инженер по эксплуатации
25) **patent engineer** - патентовед
26) **planning engineer** – инженер-конструктор; инженер-проектировщик
27) **plant engineer** – инженер-технолог; инженер по оборудованию
28) **power engineer** – инженер-энергетик
29) **process engineer** – инженер-технолог
30) **production engineer** – инженер технолог
31) **refrigerating engineer** – инженер по холодильному делу
32) **safety engineer** – инженер по технике безопасности
33) **shift engineer** – дежурный техник, сменный инженер
34) **steelmaking engineer** – инженер-сталеплавильщик
35) **systems engineer** - инженер по системному конструированию
36) **test(ing) engineer** – инженер-испытатель
37) **thermal engineer** – инженер-термист
38) **tool(ing) engineer** – технолог
39) **vacuum engineer** – технолог по вакууму
40) **water engineer** – инженер-гидротехник
41) **weight-and-balance engineer** – специалист, занимающийся центровкой самолетов и определением их весовых характеристик

II. Engineering - a) техника, конструирование; технический, инженерный; b) машиностроение; машиностроительный; c) технология; d) строительство

1. **advanced production engineering** – разработка опытного образца
2. **agricultural engineering** – агротехника
3. **architectural engineering** – строительная техника
4. **atomic power engineering** – атомная энергетика
5. **automotive engineering** – автотракторная техника
6. **chemical engineering** – химическая технология
7. **civil engineering** – гражданское строительство
8. **construction engineering** – строительная техника
9. **control engineering** – техника контроля; техника автоматического регулирования
10. **design engineering** - конструирование
11. **development engineering** - инженерное проектирование
12. **electrical engineering** - электротехника
13. **fuel engineering** – технология топлива
14. **high-frequency engineering** – высокочастотная техника
15. **hydraulic engineering** – гидротехника
16. **industrial engineering** – организация производства
17. **management engineering** – техника управления
18. **marine engineering** – судостроительная техника
19. **mechanical engineering** – машиностроение
20. **methods engineering** – технологическая разработка
21. **military engineering** - военно-инженерное дело
22. **nuclear engineering** – ядерная техника
23. **plant engineering** – промышленная эксплуатация, промышленная технология
24. **power engineering** – энергетика
25. **process engineering** – разработка технологического процесса, организация производства, технология
26. **production engineering** – организация производственного процесса, технологическое проектирование
27. **radio engineering** – радиотехника
28. **research engineering** – технические исследования
29. **structural engineering** – строительная техника
30. **systems engineering** - системный метод разработки, системотехника, системное конструирование
31. **water-power engineering** – гидротехника
32. **engineering-oriented** - при помощи технических мероприятий

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