МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное бюджетное образовательное учреждение высшего образования
«Воронежский государственный технический университет»

Строительно-политехнический колледж

МЕТОДИЧЕСКИЕ УКАЗАНИЯ

АВТОМАТИЗИРОВАННОЕ ПРОИЗВОДСТВО

к учебному материалу на английском языке для проведения практических занятий и организации самостоятельной работы по дисциплинам «Иностранный язык» и «Иностранный язык в профессиональной деятельности» для студентов специальностей 15.02.08 Технология машиностроения, 15.02.10 Мехатроника и мобильная робототехника очной формы обучения

Методические указания обсуждены на заседании методического совета СПК

«18» 02. 2022 года Протокол № 6

Председатель методического совета СПК_____ Сергеева С. И.

Методические указания одобрены на заседании педагогического совета СПК

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Методические указания к учебному материалу на английском языке для практических занятий и самостоятельной работы по дисциплинам «Иностранный язык» и «Иностранный язык в профессиональной деятельности» для студентов специальностей 15.02.08 Технология машиностроения, 15.02.10 Мехатроника и мобильная робототехника очной формы обучения / ФГБОУ ВО «Воронежский государственный технический университет»; сост. Н.В. Аленькова, 2022. 53 с.

Методические указания содержат учебные тексты и задания для аудиторной и внеаудиторной работы студентов. Они предназначены для развития навыков чтения, реферирования и аннотирования литературы по специальности, а также для развития навыков говорения и расширения терминологической лексики. Задания содержат упражнения на усвоение лексических единиц по специальности и развитие навыков говорения.

Предназначены для студентов 4 курса.

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UNIT 1
МЕХАНИКА – РАЗДЕЛ ФИЗИКИ

1. Изучите следующие слова и словосочетания:

1. science – наука,
2. nature – природа,
3. to exist – существовать,
4. vast - громадный, многочисленный,
5. matter – вещество,
6. carefully – внимательно,
7. various - различный, разный; многочисленный,
8. to occur – встречаться,
9. nuclear – ядерный,
10. in addition to - в добавление к,
11. distinct – отдельный,
12. to merge – сливаться,
13. to deal with - иметь дело,
14. primarily - первоначально, сперва,
15. knowledge – знание,
16. relative to – относящийся к,
17. motion- движение,
18. scientist – ученый,
19. velocity - скорость.

2. Прочитайте текст. Расскажите, что изучает механика и каким образом она взаимосвязана с физикой:

TEXT 1

PHYSICS GIVES WAY TO MECHANICS

Physics is one of the most ancient sciences about nature. The word "physics" takes its origin from the Greek word "phew-sis" meaning nature. Physics is the science studying various phenomena in nature: mechanical motion, heat, sound, electricity, magnetism and light. Physics is one of the main sciences about nature. The development of other sciences depends in many respects on the knowledge of physical phenomena.

Physics is divided into two great branches, experimental physics and theoretical physics. The first is the science of making observations and devising experiments, which give us accurate knowledge of the actual behaviour of natural phenomena. On the basis of experimental facts theoretical physics formulates laws and predicts the

behaviour of natural phenomena. Every physical law is based on experiments and is devised to correlate and to describe accurately these experiments. The wider the range of experience covered by such a law, the more important it is.

Physics is divided into half a dozen or more different fields - mechanics, sound, heat, electricity and magnetism, light, molecular, atomic and nuclear physics. These different fields are not distinct but merge into each other.

Mechanics (from Ancient Greek: μηχανική, mēkhanikḗ, lit. "of machines") is the area of mathematics and physics concerned with the relationships between force, matter, and motion among physical objects. Forces applied to objects result in displacements, or changes of an object's position relative to its environment.

Theoretical expositions of this branch of physics had its origins in Ancient Greece, for instance, in the writings of Aristotle and Archimedes. During the early modern period, scientists such as Galileo, Kepler, Huygens, and Newton laid the foundation for what is now known as classical mechanics.

As a branch of classical physics, mechanics primarily deals with bodies that are either at rest or are moving with velocities significantly less than the speed of light. It can also be defined as the physical science that deals with the motion of and forces on bodies not in the quantum realm.

Historically, classical mechanics had been around for nearly a quarter millennium before quantum mechanics developed. Classical mechanics originated with Isaac Newton's laws of motion in Philosophiæ Naturalis Principia Mathematica, developed over the seventeenth century. Quantum mechanics developed later, over the nineteenth century, precipitated by Planck's postulate and Albert Einstein's explanation of the photoelectric effect. Both fields are commonly held to constitute the most certain knowledge that exists about physical nature.

Classical mechanics has especially often been viewed as a model for other so-called exact sciences. Essential in this respect is the extensive use of mathematics in theories, as well as the decisive role played by experiment in generating and testing them.

Quantum mechanics is of a bigger scope, as it encompasses classical mechanics as a sub-discipline which applies under certain restricted circumstances. According to the correspondence principle, there is no contradiction or conflict between the two subjects, each simply pertains to specific situations.

Often cited as father to modern science, Galileo brought together the ideas of other great thinkers of his time and began to calculate motion in terms of distance travelled from some starting position and the time that it took. He showed that the speed of falling objects increases steadily during the time of their fall. This acceleration is the same for heavy objects as for light ones, provided air friction (air resistance) is discounted. The English mathematician and physicist Isaac Newton improved this analysis by defining force and mass and relating these to acceleration. For objects traveling at speeds close to the speed of light, Newton's laws were superseded by Albert Einstein's theory of relativity. For atomic and subatomic particles, Newton's laws were superseded by quantum theory. For everyday phenomena, however,

Newton's three laws of motion remain the cornerstone of dynamics, which is the study of what causes motion.

3. Переведите следующие слова и словосочетания. Составьте 6 – 8 предложений с любыми данными словами и словосочетаниями:

phenomenon - phenomena, nature, natural, to depend on (upon), knowledge, theory, theoretical, observation, to devise, accurate, to formulate, law, to predict, to base, on the basis of, to correlate, distinct, to merge, to deal with, primarily, in terms of, matter, hence, therefore, concept, to determine, characteristics, to govern, transformation, to exist.

4. Ответьте на следующие вопросы:

1. What is physics?
2. What phenomena does physics study?
3. From what language does the word "physics" take its origin?
4. Does the development of other sciences depend on the knowledge of physical phenomena?
5. What is experimental physics?
6. What is theoretical physics?
7. What are all physical laws based on?
8. What are the basic concepts in all physical phenomena?
9. What fields is physics divided into?
10. What is mechanics?
11. What do you know about quantum mechanics?
12. Who laid the foundation for what is now known as classical mechanics?

5. Составьте реферат текста, используя следующие выражения:

1. The title of the text is “...”. It is taken from the book “…” written by…
2. The text can be divided into … logical parts.
3. The first part/ paragraph tells us about...
4. From the second part we learn about...
5. The third part is devoted to/ gives information about/ deals with/ describes/ gives some facts about/ contains information about...
6. The main idea of the text is …
7. I can say that the text is …, which is very useful for our future professional activity.

UNIT 2
ИСТОРИЯ ПОЯВЛЕНИЯ АВТОМАТИЗАЦИИ В ПРОМЫШЛЕННОСТИ

1. Изучите следующие слова и словосочетания:

1. ancestor – предок, прародитель
2. to assemble – собирать, монтировать; assembly – сборка; узел; агрегат
3. data – данные; информация
4. to develop – создавать; развивать; совершенствовать; разрабатывать; development – развитие; сооружение; разработка; усовершенствование
5. engine – машина; двигатель; steam engine – паровая машина; analytical engine – аналитическая машина
6. to evolve – эволюционировать, развиваться
7. extension – расширение; распространение; продолжение
8. lever – рычаг, рукоятка
9. loom – ткацкий станок
10. to magnify – увеличивать; усиливать
11. muscle – мускул; сила
12. pattern – рисунок, узор; образец
13. precursor – предшественник; предвестник
14. pulley – блок; шкив
15. to punch – пробивать; перфорировать
16. technology – технология; техника; технические средства; automation technology – автоматизированная техника; технические средства автоматизации
17. trip-hammer – рычажный молот
18. wheel – колесо, маховик

2. Завершите предложения подходящими словами и словосочетаниями:

1. Simple mechanical devices, such as the wheel, the lever and the pulley…

a) did not require strength to operate.
b) were made of stone.
c) magnified the power of human muscle.

2. The first trip-hammers powered by water operated in…

a) China.
b) Greece.
c) France.

3. The device that marked the beginning of the Industrial Revolution was…

a) the windmill.
b) the steam engine.
c) the mechanical clock.

4. The Jacquard loom, one of the first concepts of a programmable machine, was designed…

a) in 1335.
b) more than 2000 years ago.
c) at the beginning of the XIX century.

5. Charles Babbage, an English mathematician, proposed a device that was the ancestor of…

a) the computer.
b) the telephone.
c) the telegraph.

3. Прочитайте текст и переведите его со словарем:

TEXT 2

HISTORICAL DEVELOPMENT OF AUTOMATION

The technology of automation has evolved from the related field of mechanization, which had its beginnings in the Industrial Revolution. Mechanization refers to the replacement of human (or animal) power with mechanical power of some form. The driving force behind mechanization has been humankind's propensity to create tools and mechanical devices. Some of the important historical developments in mechanization and automation leading to modern automated systems are described here.

The first tools made of stone represented prehistoric man's attempts to direct his own physical strength under the control of human intelligence. Thousands of years were undoubtedly required for the development of simple mechanical devices and machines such as the wheel, the lever, and the pulley, by which the power of human muscle could be magnified.

The next extension was the development of powered machines that did not require human strength to operate. Examples of these machines include waterwheels, windmills, and simple steam-driven devices. More than 2,000 years ago the Chinese developed trip-hammers powered by flowing water and waterwheels. The early Greeks experimented with simple reaction motors powered by steam. The mechanical

clock, representing a rather complex assembly with its own built-in power source (a weight), was developed about 1335 in Europe. Windmills with mechanisms for automatically turning the sails were developed during the Middle Ages in Europe and the Middle East. The steam engine represented a major advance in the development of powered machines and marked the beginning of the Industrial Revolution. During the two centuries since the introduction of the Watt steam engine, powered engines and machines have been devised that obtain their energy from steam, electricity, and chemical, mechanical, and nuclear sources.

Another important development in the history of automation was the Jacquard loom, which demonstrated the concept of a programmable machine. About 1801 the French inventor Joseph-Marie Jacquard devised an automatic loom capable of producing complex patterns in textiles by controlling the motions of many shuttles of different coloured threads. The selection of the different patterns was determined by a program contained in steel cards in which holes were punched. These cards were the ancestors of the paper cards and tapes that control modern automatic machines. The concept of programming a machine was further developed later in the 19th century when Charles Babbage, an English mathematician, proposed a complex, mechanical “analytical engine" that could perform arithmetic and data processing. Although Babbage was never able to complete it, this device was the precursor of the modern digital computer.

4. Подберите к русским словам английские эквиваленты:

1. сила	a. to direct
	b. advance
2. управлять	c. power
	d. to control
	e. development
3. усовершенствование	f. force
	g. to operate
	h. strength

5. Найдите в тексте английские эквиваленты к следующим словосочетаниям:

1. паровая машина, 2. исторические достижения, 3. промышленная революция, 4. сложная конструкция (агрегат), 5. следующий шаг, 6. важное достижение, 7. источник ядерной энергии, 8. обработка информации, 9. паровой двигатель, 10. предшественник цифровой вычислительной машины.

6. Найдите 9 названий механизмов (устройств, приборов, инструментов, станков), о которых упоминается в тексте:

t	**r**	**i**	**p**	**h**	**a**	**m**	**m**	**e**	**r**
g	**m**	**e**	**w**	**l**	**o**	**d**	**y**	**p**	**a**
h	**o**	**j**	**i**	**w**	**k**	**j**	**i**	**u**	**q**
v	**t**	**i**	**n**	**h**	**t**	**o**	**o**	**l**	**n**
l	**o**	**w**	**d**	**g**	**k**	**p**	**m**	**l**	**r**
t	**r**	**i**	**m**	**h**	**a**	**m**	**m**	**e**	**r**
l	**n**	**e**	**i**	**f**	**b**	**s**	**t**	**y**	**c**
o	**o**	**o**	**l**	**e**	**v**	**e**	**r**	**d**	**f**
o	**p**	**d**	**l**	**e**	**l**	**c**	**a**	**m**	**b**
m	**x**	**y**	**z**	**e**	**n**	**g**	**i**	**n**	**e**
w	**a**	**t**	**e**	**r**	**w**	**h**	**e**	**e**	**l**

7. Заполните пропуски подходящими по смыслу словами:

a. engine, b. power, c. devices, d. water, e. computer, f. mechanisms, g. assembly, h. machine.

1. Mechanization refers to the replacement of human … with mechanical power.
2. Simple mechanical … were replaced by powered machines.
3. The Chinese developed trip-hammers powered by flowing …
4. The mechanical clock represented a complex … with its own built-in power source.
5. Windmills had … for automatical turning the sails.
6. The Watt steam … marked the beginning of the Industrial Revolution.
7. The Jacquard loom demonstrated the concept of a programmable … .
8. The “analytical engine” proposed by Charles Babbage was the precursor of the modern digital…

8. Заполните пустые ячейки на рис. 1, используя информацию из текста:

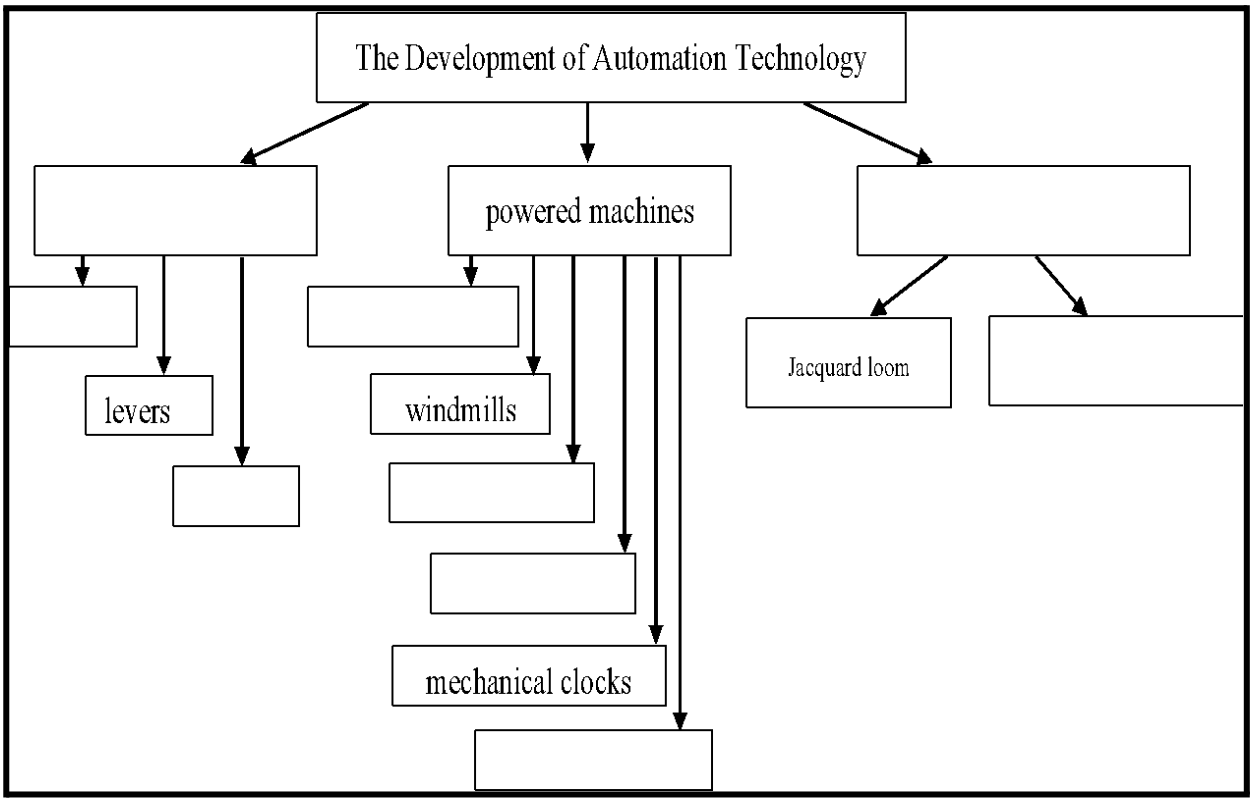


Рис. 1 Схема спайдограммы развития автоматизированного производства

9. Расскажите, что вы узнали об истории развития автоматизированного производства, используя план из упражнения 6 Unit 1 и сведения из рис. 1.

UNIT 3
РАЗВИТИЕ МЕХАНИЧЕСКОЙ ИНЖЕНЕРИИ

1. Изучите следующие слова и словосочетания:

1. *to mount on an axle – установить на ось;*
2. *a sophisticated device/ machine – сложное устройство/ машина/ станок;*
3. *an enormous impetus – значимый импульс;*
4. *to receive formal recognition – получить официальное признание;*
5. *machinery – механическое оборудование;*
6. *mechanical engineering – машиностроение, механическая инженерия;*
7. *research – исследование*;
8. *to evolve – развиться, выделиться из;*
9. *trial and error – метод проб и ошибок;*
10. *a quality – качество;*

11. *to obtain high rates of production – получить высокие темпы производства;*
12. *accuracy and complexity – точность и сложность;*
13. *to owe – быть должным, обязанным чему-либо;*
14. *a requirement – требование;*
15. *to be closely integrated with – быть тесно связанным с;*
16. *a manufacturing process – производственный процесс;*
17. *a versatile machine tool – универсальный станок.*

2. Переведите предложения с русского на английский:

1. На заводе следят за высоким качеством выпускаемых товаров.
2. Важно помнить, что при производстве этой детали требуется дорогое механическое оборудование.
3. Роботы-пылесосы набирают высокие темпы производства благодаря повышенному спросу.
4. Мой брат изучает основы механической инженерии в колледже.
5. Механика тесно связана с математикой и программированием, но обязана своим появлением, в первую очередь, физике.
6. Сложность производственного процесса и высокая точность тормозят массовый выпуск роботизированных автомобилей.
7. Стиральная машина представляет собой сложное механическое устройство.
8. Исследование показало, что проблемы, связанные с автоматизацией производства, представляют для студентов особый интерес.
9. Студенты изготовили программируемый замок методом проб и ошибок.

3. Прочитайте текст и переведите его со словарем:

TEXT 3

FROM THE HISTORY OF MECHANICAL ENGINEERING

Mechanical engineering is one of the oldest branches of engineering, dating back to when the first wheels were put to practical use by mounting them on an axle to make a cart. Throughout recorded history, people have been inventing and building increasingly more sophisticated devices and machines in order to improve their life conditions. Many of the machines we encounter every day - cars, appliances, tools and climate control systems - were made possible by mechanical engineers.

"Mechanical engineering dates to ancient Greece and China, where mechanisms like screw pumps, steam engines, clocks, seismometers and even differential gears were invented," according to the American Society of Mechanical

Engineers (ASME). Pioneers in the field - people who built the machines for which they became famous - include Archimedes (Archimedes' screw pump, block-and-tackle pulley, etc.), Johannes Gutenberg (movable-type printing press), James Watt (steam engine), Robert Fulton (steamboat), Eli Whitney (cotton gin) and Henry Ford (automobile assembly line).

It is well-known that the invention of the steam engine in the latter part of the 18th century, providing a key source of power for the Industrial Revolution, gave an enormous impetus to the development of machinery of all types. As a result, a new major classification of engineering dealing with tools and machines developed, receiving formal recognition in 1847 in the founding of the Institution of Mechanical Engineers in Birmingham, England.

Mechanical engineering has evolved from the practice by the mechanic of an art based largely on trial and error to the application by the professional engineer of the scientific method in research, design, and production. The demand for increased efficiency is continually raising the quality of work expected from a mechanical engineer and requiring a higher degree of education and training.

Nowadays, the high standard of living in the developed countries owes much to mechanical engineering. The mechanical engineer invents machines to produce goods and develops machine tools of increasing accuracy and complexity to build the machines.

The principal lines of development of machinery have been an increase in the speed of operation to obtain high rates of production, improvement in accuracy to obtain quality and economy in the product, and minimization of operating costs. These three requirements have led to the evolution of complex control systems.

The most successful production machinery is that in which the mechanical design of the machine is closely integrated with the control system. A modern transfer (conveyor) line for the manufacture of automobile engines is a good example of the mechanization of a complex series of manufacturing processes.

Developments are in hand to automate production machinery further, using computers to store and process the vast amount of data required for manufacturing a variety of components with a small number of versatile machine tools.

4. Ответьте на вопросы:

1. What is mechanical engineering?
2. What was a reason that people were inventing and building increasingly more sophisticated devices and machines?
3. What ancient mechanisms do you know?
4. What gave an enormous impetus to the development of machinery of all types?
5. When was the Institution of Mechanical Engineers in Birmingham founded?
6. What is expected from a mechanical engineer?
7. What helps to obtain high rates of production?

8. What production machinery can be called the most successful?
9. What examples of the mechanization of a complex series of manufacturing processes can you name?
10. How are computers used to automate production machinery?

5. Расскажите, что вы узнали об истории развития механической инженерии, используя план из упражнения 6 Unit 1.

UNIT 4
АВТОМАТИЗАЦИЯ

1. Изучите следующие слова и словосочетания:

1. to accomplish – выполнять; завершать
2. to weld – сваривать; weld – сварной шов; to spot weld – осуществлять точечную сварку; weld spot – сварная точка
3. arm – механическая рука; рычаг; рукоятка
4. to attribute – приписывать, относить
5. body – корпус
6. to define – определять, давать определение; definition – определение
7. to ensure – обеспечивать; гарантировать
8. to execute – выполнять; исполнять; execution – выполнение; исполнение
9. feedback – обратная связь; feedback control – управление с обратной связью; автоматическое регулирование с обратной связью
10. to intervene – вмешиваться; intervention – вмешательство; посредничество
11. to load – загружать; закладывать; to unload – выгружать; разгружать
12. to mature – созревать
13. to mean – значить, означать; means – средство; способ; by means of –посредством
14. to surpass – превосходить, превышать
15. sequence – последовательность; чередование; цикл
16. production line – поточная линия
17. to relate – относиться; быть связанным с ...; computer-related – связанный с применением компьютера
18. robot – робот; автоматический манипулятор; robotics – робототехника

2. Дайте нижеперечисленным словосочетаниям английские эквиваленты. Выберите 5 любых словосочетаний и составьте предложения с ними:

1. важные разработки, 2. соответствующие вычисления, 3. интегральные схемы, 4. выполнять расчёты, 5. многоконтурное устройство, 6. запоминающая среда, 7. языки программирования, 8. измерительные приборы, 9. система управления с обратной связью, 10. электромеханические контактные датчики, 11. машинное зрение, 12. сенсорные системы, 13. обработка информации, 14. линейные простые дифференциальные уравнения, 15. умственные способности, 16. искусственный интеллект.

3. Подберите к каждому слову из левой колонки определение:

1. Automation	a. The use of computers to control a particular process often by means of the replacement of employees.
2. Robotics	b. The science and technology relating to computer-controlled mechanical devices such as the automated tools commonly found on automobile assembly lines.
3. Mechanization	c. The replacement of human muscle by mechanical power.

4. Прочитайте текст и переведите со словарем:

TEXT 4

AUTOMATION TECHNOLOGY

Automation is the application of machines to tasks once performed by human beings or, increasingly, to tasks that would otherwise be impossible. Although the term “mechanization” is often used to refer to the simple replacement of human labour by machine, automation generally implies the integration of machines into a self-governing system. Automation has revolutionized those areas in which it has been introduced, and there is scarcely an aspect of modern life that has been unaffected by it.

The term “automation” was coined in the automobile industry (about in 1946) to describe the increased use of automatic devices and controls in mechanized production lines. The origin of the word is attributed to D.S. Harder, an engineering manager at the Ford Motor Company at the time. The term is used widely in a manufacturing context, but it is also applied outside manufacturing in connection with a variety of systems in which there is a significant substitution of mechanical, electrical, or computerized action for human effort and intelligence.

In general usage, automation can be defined as a technology concerned with performing a process by means of programmed commands combined with automatic feedback control to ensure proper execution of the instructions. The resulting system is capable of operating without human intervention. The development of this

technology has become increasingly dependent on the use of computers and computer-related technologies. Consequently, automated systems have become increasingly sophisticated and complex. Advanced systems represent a level of capability and performance that surpass in many ways the abilities of humans to accomplish the same activities.

Automation technology has matured to a point where a number of other technologies have developed from it and have achieved recognition and status of their own. Robotics is one of these technologies; it is a specialized branch of automation in which the automated machine possesses certain anthropomorphic, or humanlike, characteristics. The most typical human like characteristic of a modern industrial robot is its powered mechanical arm. The robot's arm can be programmed to move through a sequence of motions to perform useful tasks, such as loading and unloading parts at a production machine or making a sequence of spot-welds on the sheet-metal parts of an automobile body during assembly. As these examples suggest, industrial robots are typically used to replace human workers in factory operations.

Moreover, artificial intelligence plays an important role in the automation process. This advanced field of computer science helps to program the computer of a robot to exhibit characteristics commonly associated with human intelligence. These characteristics include the capacity for learning, understanding languages, reasoning, solving problems, rendering expert diagnoses, and similar mental capabilities. The developments in artificial intelligence are expected to provide robots and other "intelligent" machines with the ability to communicate with humans and to accept very high-level instructions rather than the detailed step-by-step programming statements typically required of today's programmable machines. For example, a robot of the future endowed with artificial intelligence might be capable of accepting and executing the command "assemble the product." Present-day industrial robots must be provided with a detailed set of instructions specifying the locations of the product's components, the order in which they are to be assembled, and so forth

5. Выберите правильный ответ:

1. Mechanization is often used to refer to the simple replacement of …
a) human labour by machine.
b) mechanical power by human operators.
c) machine tools by robotic systems.

2. The term “automation” was first used …
a) in the computer industry.
b) in the robot industry.
c) in the automobile industry.

3. Any automated system is capable of operating…
a) under human control.

b) without human intervention.

4. Robot is a mechanical device that…
a) looks like a human being.
b) possesses human-like characteristics.
c) performs a variety of complex technical tasks.

6. Ответьте на вопросы:

1. What does the term “automation” mean?
2. What is the difference between automation and mechanization?
3. When was the term “automation” coined?
4. Whose name is the origin of the word “automation” attributed to?
5. What is the definition of automation?
6. What does the development of automation technology depend on?
7. What advanced technology has developed from automation technology?
8. What are the main characteristics of industrial robotics?
9. What is the most typical human like characteristic of an industrial robot?
10. What operations can the robot’s arm be programmed for?
11. What is the main purpose of industrial robots?

7. Переведите текст 4А письменно:

TEXT 4A

AUTOMATION IN INDUSTRY

Many industries are highly automated or use automation technology in some part of their operation. In communications and especially in the telephone industry dialing and transmission are all done automatically. Railways are also controlled by automatic signaling devices, which have sensors that detect carriages passing a particular point. In this way the movement and location of trains can be monitored.

Not all industries require the same degree of automation. Sales, agriculture, and some service industries are difficult to automate, though the agriculture industry may become more mechanized, especially in the processing and packaging of foods.

The automation technology in manufacturing and assembly is widely used in car and other consumer product industries.

Nevertheless, each industry has its own concept of automation that answers its particular production needs.

8. **Составьте реферат текста, используя план из упражнения 6 Unit 1.**

UNIT 5

ОСНОВНЫЕ ПРИНЦИПЫ АВТОМАТИЗАЦИИ

1. Изучите слова и выражения:

1. available – имеющийся в распоряжении
2. delivery – доставка; передача
3. to entail – влечь за собой; вызывать
4. entity – объект; категория
5. to exhibit – демонстрировать; проявлять
6. fuel – топливо; fossil fuel – органическое топливо
7. location – местоположение; размещение; ячейка
8. molding – формовка, формование; отливка
9. positioning – размещение, определение местоположения
10. product – изделие
11. readily – легко; быстро
12. shaping – придание формы, формование; фасонирование
13. to transfer – переносить, перемещать; передавать; transfer – перенос, перемещение; передача
14. unit – блок; узел; установка; агрегат; устройство
15. valuable – ценный; полезный
16. versatile – многосторонний; гибкий

2. Прочитайте текст, переведите и расскажите о трех самых важных составляющих процесса автоматизации:

TEXT 5

PRINCIPLES AND THEORY OF AUTOMATION

The developments described above have provided the three basic building blocks of automation:

(1) a source of power to perform some action,
(2) feedback controls, and
(3) machine programming.

Almost without exception, an automated system will exhibit all these elements.

An automated system is designed to accomplish some useful action, and that action requires power. There are many sources of power available, but the most commonly used power in today's automated systems is electricity. Electrical power is the most versatile, because it can be readily generated from other sources (e.g., fossil fuel, hydroelectric, solar, and nuclear) and it can be readily converted into other types of power (e.g., mechanical, hydraulic, and pneumatic) to perform useful work. In addition, electrical energy can be stored in high-performance, long-life batteries.

The actions performed by automated systems are generally of two types: (1) processing and (2) transfer and positioning.

In the first case, energy is applied to accomplish some processing operation on some entity. The process may involve the shaping of metal, the molding of plastic, the switching of electrical signals in a communication system, or the processing of data in a computerized information system. All these actions entail the use of energy to transform the entity (e.g., the metal, plastic, electrical signals, or data) from one state or condition into another, more valuable state or condition.

The second type of action – transfer and positioning – is most readily seen in automated manufacturing systems designed to perform work on a product. In these cases, the product must generally be moved (transferred) from one location to another during the series of processing steps. At each processing location accurate positioning of the product is generally required. In automated communications and information systems the terms "transfer" and "positioning" refer to the movement of data (or electrical signals) among various processing units and the delivery of information to output terminals (printers, video display units, etc.) for interpretation and use by humans.

3. Ответьте на вопросы:

1. What are the main elements of automation?
2. What is the most commonly used power in today's automated systems?
3. In what devices can electrical energy be stored?
4. What actions can automated systems perform?

4. Составьте реферат текста, используя план из упражнения 6 Unit 1.

5. Заполните пропуски подходящими по смыслу словами:

a. action, b. elements, c. terminals, d. power, e. converted, f. sources, g. transfer.

1. Any automated system has three basic … .
2. Any useful action accomplished by an automated system requires … .
3. Electrical power can be generated from different … .
4. Electrical power can be ... into mechanical power.
5. Automated systems perform two types of … .
6. The term "…" refers to the movement of data.
7. The processed information is delivered to output … .

6. Прочитайте и переведите текст 5A письменно со словарем:

TEXT 5A

ОСНОВНЫЕ ЭЛЕМЕНТЫ АВТОМАТИЗИРОВАННОЙ СИСТЕМЫ

Любая автоматизированная система имеет три основных элемента: источник энергии, управление с обратной связью, программирование машины (станка). Каждая автоматизированная система требует источника питания.

Существуют разные источники питания, но наиболее универсальным источником является электроэнергия. Электроэнергию можно получить из органического топлива; из гидравлической, солнечной и ядерной энергии. В свою очередь, её можно преобразовать в механическую, пневматическую, тепловую и другие виды энергии для выполнения полезной работы. Кроме того, электроэнергия может накапливаться в долговечных батареях.

Действия, выполняемые автоматизированными системами, заключаются в обработке, перемещении и расположении. В автоматизированных коммуникационно-информационных системах данные перемещаются от одного блока обработки к другому, и полученная информация выводится на терминалы.

7. Расскажите, что вы узнали об автоматизации, используя план из упражнения 6 Unit 1

UNIT 6
МЕХАТРОНИКА

1. Изучите следующие слова и словосочетания:

1. multi- disciplinary – междисциплинарный;
2. to be coined by – быть придуманным;
3. diverse – разнообразный;
4. to involve – касаться, затрагивать, вовлекать;
5. intelligent – умный, отличающийся интеллектом;
6. to be incorporated into – быть включенным в;
7. to be featured in – быть представленным в;
8. consumer products - потребительские товары;
9. achievement – достижение;
10. delivery – доставка;
11. refined approach – усовершенствованный подход.

2. Прочитайте эти слова и словосочетания и догадайтесь о их значении:

Mechatronics, engineer, mechanical and electrical products and systems, telecommunications, control, electronics, robotics, design, mechanics, technical specialties, disciplines, programming, automobiles, replicate human actions, software, sensors and instruments, limitations, aviation.

3. Прочитайте текст и переведите:

TEXT 6

WHAT IS MECHATRONIC ENGINEERING?

Mechatronics, which is also referred to as mechatronic engineering, is a multidisciplinary field of engineering that concentrates on the engineering of both mechanical and electrical products and systems, and also involves the merging of electronics, robotics, computer, systems, telecommunications, product and control engineering. The term “mechatronics” was coined by Tetsuro Mori, the senior engineer of the Japanese company Yaskawa in 1969. An industrial robot is a prime example of a mechatronics system; it includes aspects of electronics, mechanics, and computing to do its day-to-day jobs.

Technology has continued to advance as time passes, and many sub-fields of engineering have been successful in both multiplying and adapting. The aim of mechatronics is to create a design solution that utilizes each of these diverse subfields. At the beginning, the mechatronics field was supposed to be no more than a merging of electronics and mechanics, which is the reason why the name is a combination of the two words. However, as the technical systems became more complicated and continued to progress, the definition has been changed to involve the more technical specialties.

Mechatronics is a branch of engineering that focuses on designing, creating, and maintaining intelligent machines that have both mechanical and electronic components. It has been incorporated into a variety of other disciplines, including computer engineering, systems engineering, and programming. It is used in sectors like electrical engineering, advanced manufacturing, and mechanical systems (См. рис. 2). A good example of mechatronics is today’s automobiles. Robotics is another example, producing robots that substitute or replicate human actions using electronic parts that respond to the commands of central computer software.

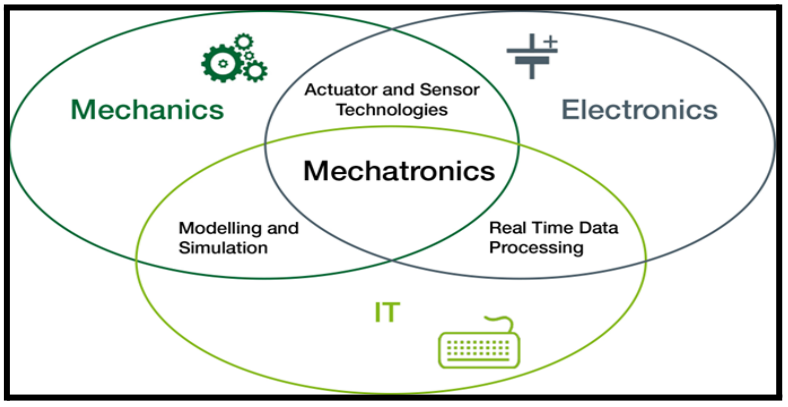


Рис. 2 Взаимосвязь мехатроники с механикой, электроникой и программированием

Mechatronics holds an important place in today's world. It is featured in a wide range of consumer products and has many other applications, including those listed below:

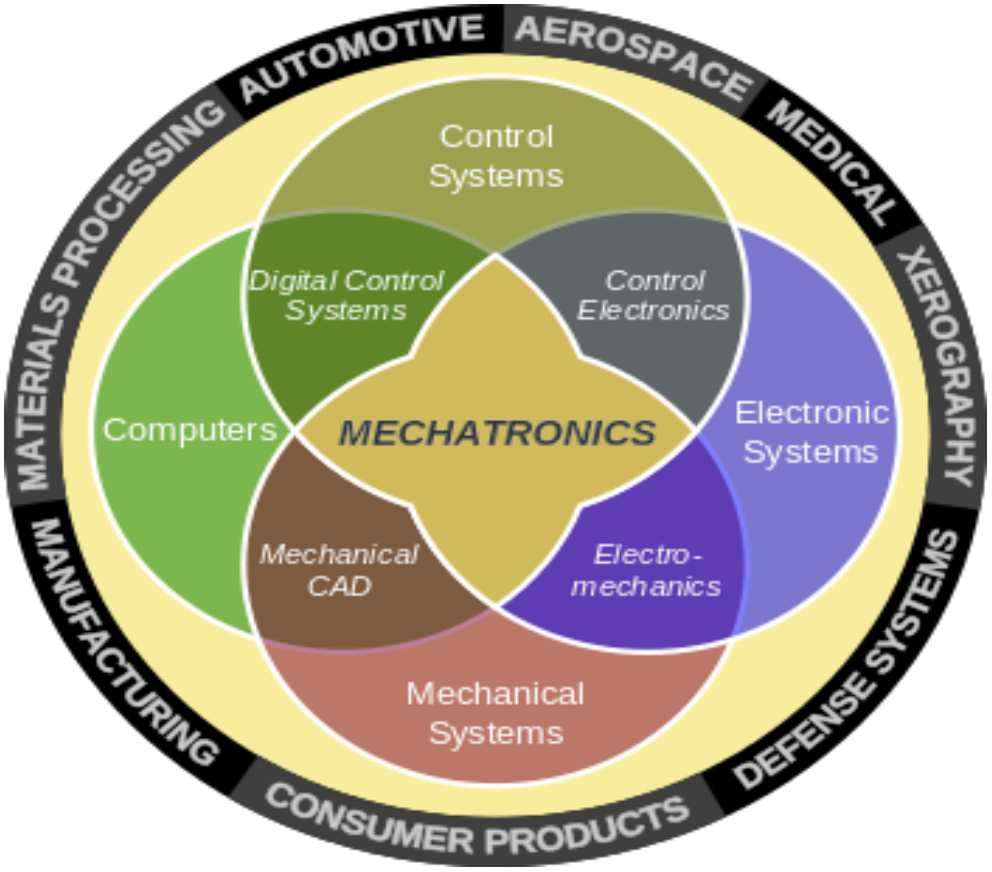
1) *Factory automation*. Mechatronics engineering is used to create devices that allow factory production of goods. Control systems for packaging or bottling food and drink products are all made with mechatronics engineering.

2) *Drones.* Drones are a perfect example of the achievements made possible by mechatronics. They are a blend of mechanical and electrical engineering that have been applied in many new sectors in recent decades. From product delivery to military operations, drones now play an important role in our society.

3) *Aviation*. Mechatronics is also used in aerospace and aviation. It provides us with new, refined approaches to aviation tasks.

4) *Robotics.* The field of advanced robotics has fewer limitations thanks to mechatronics. Mechatronics has led to the creation of new sensors and instruments that have wide uses in robotics.

4. Рассмотрите ассоциативную эмблему и расскажите что вы знаете про мехатронику, какие разделы она в себя включает и для каких целей используется:



5. Составьте реферат текста, используя план из упражнения 6 Unit 1.

UNIT 7
ПРОГРАММИРОВАНИЕ МЕХАТРОННЫХ СИСТЕМ И КОМПЛЕКСОВ

1. Изучите следующие слова и выражения:

1. *adjustment – регулировка; настройка; согласование*
2. *advantage – преимущество; выгода, польза*
3. *to alter – изменять(ся); переделывать*
4. *cam – кулачок; выступ на(распределительном) валу*
5. *capability – способность*
6. *capacity – возможность; способность*
7. *circumstance – обстоятельство; условие*
8. *consideration – рассмотрение, обсуждение; внимание; to take into consideration – принимать во внимание; considerable – значительный; важный*
9. *content – содержание; содержимое*
10. *to convert – преобразовывать*
11. *decision – решение; to make a decision – принимать решение*
12. *deviation – отклонение*
13. *error – ошибка; погрешность*
14. *to exert – осуществлять*
15. *fashion – образ; форма, вид; стиль*
16. *to flip – перебрасывать(ся)*
17. *to improve – улучшать(ся); совершенствовать(ся)*
18. *to involve – включать в себя; влечь за собой*
19. *linkage – сцепление; соединение*
20. *means – способ; средство; средства*
21. *monitoring – слежение, контроль, мониторинг*
22. *proper – правильный; подходящий; должный; properly – правильно; должным образом*
23. *to provide for – предусматривать; to provide with – снабжать; обеспечивать*
24. *raw – сырой, необработанный, неочищенный*
25. *recovery – восстановление; возврат (к заданному значению)*
26. *to relate – относиться*
27. *to respond – отвечать; реагировать*
28. *response – ответ*
29. *safety – безопасность; надёжность*
30. *to sophisticate – усложнять*
31. *to specify – устанавливать; указывать; определять*
32. *to store – запоминать, хранить; storage – запоминание, хранение; память*
33. *to verify – проверять; подтверждать*

2. Прочитайте текст и переведите:

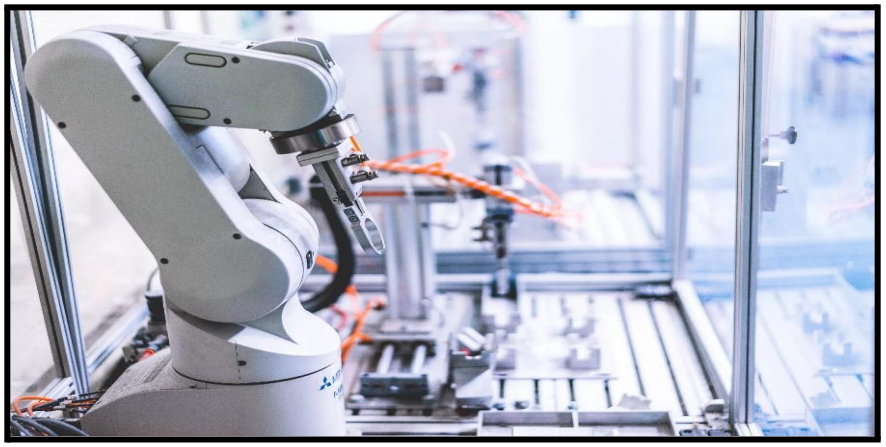
TEXT 7

MACHINE PROGRAMMING

The programmed instructions determine the set of actions that is to be accomplished automatically by the system. The program specifies what the automated system should do and how its various components must function in order to accomplish the desired result. The content of the program varies considerably from one system to the next. In relatively simple systems the program consists of a limited number of well-defined actions that are performed continuously and repeatedly in the proper sequence with no deviation from one cycle to the next. In more complex systems the number of commands could be quite large, and the level of detail in each command could be significantly greater. In relatively sophisticated systems the program provides for the sequence of actions to be altered in response to variations in raw materials or other operating conditions.

Programming commands are related to feedback control in an automated system in that the program establishes the sequence of values for the inputs (set points) of the various feedback control loops that make up the automated system. A given programming command may specify the set point for the feedback loop, which in turn controls some action that the system is to accomplish. In effect, the purpose of the feedback loop is to verify that the programmed step has been carried out. For example, in a robot controller the program might specify that the arm is to move to a designated position, and the feedback control system is used to verify that the move has been correctly made.

Some of the programmed commands may be executed in a simple open-loop fashion – i.e., without the need for a feedback loop to verify that the command has been properly carried out. For example, a command to flip an electrical switch may not require feedback. The need for feedback control in an automated system might arise when there are variations in the raw materials being fed into a production process, and the system must take these variations into consideration by making adjustments in its controlled actions. Without feedback the system would be unable to exert sufficient control over the quality of the process output.



The programmed commands may be contained on mechanical devices (e.g., mechanical cams and linkages), punched paper tapes, magnetic tapes, magnetic disks, computer memory, or any of a variety of other media that have been developed over the years for particular applications. It is common today for automated equipment to use computer storage technology as the means for storing the programmed commands and converting them into controlled actions. One of the advantages of computer storage is that the program can be readily changed or improved. Altering a program that is contained on mechanical cams involves considerable work.

Programmable machines are often capable of making decisions during their operation. The decision-making capacity is contained in the control program in the form of logical instructions that govern the operation of such a system under varying circumstances. Under one set of circumstances the system responds one way; under different circumstances it responds in another way. There are several reasons for providing an automated system with decision-making capability, including (1) error detection and recovery, (2) safety monitoring, (3) interaction with humans, and (4) process optimization.

3. Переведите предложения на английский язык:

1. Автоматизированная система осуществляет набор действий, определяемых программой.
2. В простых системах программа включает ограниченное число действий, в сложных системах число запрограммированных команд гораздо больше.
3. В автоматизированной системе запрограммированные команды связаны с управлением с обратной связью.
4. Цель управления с обратной связью – проверить точное выполнение запрограммированной операции.
5. Запрограммированные команды могут содержаться на механических устройствах, перфолентах, магнитных лентах и магнитных дисках.
6. Автоматизированное оборудование использует технологию компьютерной памяти.
7. Программируемые машины способны принимать решения во время своей работы.
8. Способность принимать решения заключается в управляющей программе в форме логических команд.

4. Ответьте на следующие вопросы:

1. What is a programmed instruction?
2. What is a program?
3. Does the content of the program vary from one system to another? Why?
4. What kinds of media may contain the programmed commands?
5. What is the decision-making capacity of programmable machines?

5. Составьте реферат текста, используя план из упражнения 6 Unit 1.

UNIT 8
КОМПЬЮТЕРНОЕ УПРАВЛЕНИЕ ТЕХНОЛОГИЧЕСКИМ ПРОЦЕССОМ

1. Изучите следующие слова и выражения:

1. actuation – приведение в действие
2. alarm – аварийный сигнал
3. to facilitate – содействовать; облегчать; facility –устройство; facilities – оборудование; аппаратура
4. furnace – печь; горн; топка
5. handling – управление, манипулирование; загрузка-разгрузка; транспортировка
6. horn – рожок
7. to implement – осуществлять, выполнять; внедрять
8. to maintain – обслуживать
9. message –сообщение
10. to process – обрабатывать; processing – обработка; process – (технологический) процесс; process industry – обрабатывающая промышленность
11. rate – скорость; интенсивность
12. sampling – апробирование; выборочный контроль; sample – образец; проба; выборка
13. valve – клапан; распределитель
14. variable – переменная величина
15. yield – объём выпуска; производительность; эффективность.

2. Закончите предложения подходящим вариантом:

1. In computer process control the purpose of digital computer is
a) to store the programmed commands.
b) to direct the operations of a manufacturing process.

2. The modern computer process control system can measure
a) temperature, flow rate, and pressure.
b) the productivity of a process plant.

3. The typical modern process plant is
a) computer-controlled.
b) mechanized.

4. All computers of the plant are connected to the central computer
a) in a random order.
b) in a hierarchical configuration.

5. Each process computer monitors the parameters that are required
a) to control the central computer.
b) to control the process of manufacturing.

6. The central computer is able to
a) integrate all the data from the process computers.
b) process data in numerical form.

3. Прочитайте журнальную заметку и выберите подходящее название. Объясните свой выбор:

TEXT 8

a) CONTROL ALGORITHMS
b) COMPUTER PROCESS CONTROL
c) MANUFACTURING PROCESS

In computer process control a digital computer is used to direct the operations of a manufacturing process. Although other automated systems are typically controlled by computer, the term "computer process control" is generally associated with continuous or semi-continuous production operations involving materials such as chemicals, petroleum, foods, and certain basic metals. In these operations the products are typically processed in gas, liquid, or powder form to facilitate the flow of the material through various steps of the production cycle. In addition, these products are usually mass-produced. Because of the ease of handling the product and the large volumes involved, a high level of automation has been accomplished in these industries.

The modern computer process control system generally includes the following: (1) measurement of important process variables such as temperature, flow rate, and pressure; (2) execution of some optimizing strategy; (3) actuation of such devices as valves, switches, and furnaces that enable the process to implement the optimal strategy; and (4) generation of reports to management indicating equipment status, production performance, and product quality. Today computer process control is applied to many industrial operations, two of which are described below.

The typical modern process plant is computer-controlled. In one petrochemical plant that produces more than 20 products, the facility is divided into three areas, each with several chemical-processing units. Each area has its own process-control computer to perform scanning, control, and alarm functions. The computers are connected to the central computer in a hierarchical configuration. The central computer calculates how to obtain maximum yield from each process and generates management reports on the process performance.

Each process computer monitors up to 2,000 parameters that are required to control the process, such as temperature, flow rate, pressure, liquid level, and chemical concentration. These measurements are taken on a sampling basis; the time

between samples varies between 2 and 120 seconds, depending on the relative need for the data. Each computer controls approximately 400 feedback control loops. Under the normal operation each control computer maintains the operation of its process at or near optimum performance levels. If process parameters exceed the specified normal or safe ranges, the control computer actuates a signal light and an alarm horn and prints a message indicating the nature of the problem for the technician. The central computer receives the data from the process computers and performs calculations to optimize the performance of each chemical-processing unit. The results of these calculations are then passed to the individual process computers in the form of changes in the set points for various control loops.

Substantial economic advantages are obtained from this type of computer control in the process industries. The computer hierarchy is capable of integrating all the data from many individual control loops far better than humans are able to do, thus permitting a higher level of performance. Advanced control algorithms can be applied by the computer to optimize the process. In addition, the computer is capable of sensing the process conditions that indicate the unsafe or abnormal operation much more quickly than humans can. All these improvements increase productivity, efficiency, and safety during the process operation.

4. Ответьте на следующие вопросы:

1. What is a “computer process control”?
2. What does the modern computer process control system generally include?

5. Составьте реферат текста, используя план из упражнения 6 Unit 1.

UNIT 9
КОМПЬЮТЕРНО-ИНТЕГРИРОВАННОЕ ПРОИЗВОДСТВО

1. Изучите следующие слова и выражения:

1. *activity – деятельность*
2. *circuit – схема, цепь*
3. *comprehensive – обширный; всесторонний*
4. *computer-aided design (CAD) – система автоматизированного проектирования (САПР)*
5. *computer-aided manufacturing (CAM) – автоматизированная система управления производством, технологическими процессами (АСУП, АСУТП)*
6. *computer-integrated manufacturing (CIM) – производство с комплексным управлением от ЭВМ*
7. *customer – заказчик; клиент*
8. *to draft – делать чертёж; проектировать*

drafting board – чертёжная доска

9. *to draw – чертить; рисовать*

drawing – чертёж; рисунок

10. *to entail – влечь за собой; вызывать*

11. to extend – простирать(ся)
12. to invoke – вызывать; активизировать(процедуру)
13. numerical control (NC) – числовое программное управление (ЧПУ)
14. order – заказ
15. to schedule – назначать, намечать; планировать; составлять график (расписание)
scheduling – оперативное управление; планирование
16. scope – размах, охват
17. shipment – погрузка; отправка
18. to support – поддерживать; способствовать, содействовать
19. trend – общее направление, тенденция

2. Выберите подходящий ответ:

1. The technology of CAD/CAM was introduced into manufacturing firms in
a) the 1970.
b) the 1980.

2. CAD/CAM technology is associated with the use of computers to perform many functions related to
a) production lines.
b) design and production.

3. Computer's assisting in the creation, modification, analysis, and optimization of a design is the purpose of
a) computer-aided manufacturing.
b) computer-aided design.

4. Computer-aided manufacturing is the use of computers to control production processes by means of
a) numerically controlled (NC) machines.
b) simple mechanical devices.

5. Computer-integrated manufacturing includes all the engineering functions of CAD/CAM and
a) the production functions of the firm.
b) the business functions of the firm.

3. Переведите словосочетания на русский язык:

1. design and production functions, 2. computer applications scope, 3. part and product specifications, 4. electronics products, 5. equipment design and fabrication, 6. computer database, 7. design-and-manufacturing procedure, 8. heat transfer

calculations, 9. final object design, 10. computer-aided design system, 11. computer process monitoring, 12. process-performance results, 13. planning and management functions, 14. step-by-step process, 15. information-processing function.

4. Прочитайте текст и переведите:

TEXT 9

COMPUTER-INTEGRATED MANUFACTURING

Since about 1970, there has been a growing trend in manufacturing firms toward the use of computers to perform many functions related to design and production. The technology associated with this trend is called CAD/CAM, for computer-aided design and computer-aided manufacturing. Today it is widely recognized that the scope of computer applications must extend beyond design and production to include the business functions of the firm. The name given to this more comprehensive use of computers is computer-integrated manufacturing (CIM).

CAD/CAM is based on the capability of a computer system to process, store, and display large amounts of data representing part and product specifications. For mechanical products, the data represent graphic models of the components; for electrical products, they represent circuit information; and so forth. CAD/CAM technology has been applied in many industries, including machined components, electronics products, and equipment design and fabrication for chemical processing. CAD/CAM involves not only the automation of the manufacturing operations but also the automation of elements in the entire design-and-manufacturing procedure.

Computer-aided design (CAD) makes use of computer systems to assist in the creation, modification, analysis, and optimization of a design. The designer, working with the CAD system rather than the traditional drafting board, creates the lines and surfaces that form the object (product, part, structure, etc.) and stores this model in the computer database. By invoking the appropriate CAD software, the designer can perform various analyses on the object, such as heat transfer calculations. The final object design is developed as adjustments made on the basis of these analyses. Once the design procedure has been completed, the computer -aided design system can generate the detailed drawings required to make the object.

Computer-aided manufacturing (CAM) involves the use of computer systems to assist in the planning, control, and management of production operations. This is accomplished by either direct or indirect connections between the computer and production operations. In the case of the direct connection, the computer is used to monitor or control the processes in the factory. Computer process monitoring involves the collection of data from the factory, the analysis of the data, and the communication of process-performance results to the plant management. These measures increase the efficiency of the plant. Computer process control entails the use of the computer system to execute control actions to operate the plant automatically, as described above. Indirect connections between the computer system

and the process involve applications in which the computer supports the production operations without actually monitoring or controlling them. These applications include planning and management functions that can be performed by the computer (or by humans working with the computer) more efficiently than by humans alone. Examples of these functions are planning the step-by-step processes for the product, part programming in numerical control (NC), and scheduling the production operations in the factory.

Computer-integrated manufacturing includes all the engineering functions of CAD/CAM and the business functions of the firm as well. In an ideal CIM system, computer technology is applied to all the operational and information-processing functions of the company, from customer orders through design and production (CAD/CAM) to product shipment and customer service. The scope of the computer system includes all activities that are concerned with manufacturing. In many ways, CIM represents the highest level of automation in manufacturing.

5. Выберите подходящее слово и переведите предложение:

1. Manufacturing (a equipment, b. firms, c. elements) use computers for design and production.
2. CAD/CAM technology includes the business (a. functions, b. automation, c. collection) of the firm as well.
3. CIM means computer-integrated (a. management, b. modification, c. manufacturing).
4. CAD/CAM technology is applied in many (a. industries, b. laboratories, c. specifications).
5. CAD/CAM involves (a. models, b. processing, c. automation) of manufacturing operations.
6. The designer stores the model of the object in the computer (a. input unit, b. database, c. output unit).

6. Ответьте на следующие вопросы:

1. What is CAD/CAM technology based on?
2. What industries has it been applied in?
3. What is its main function?
4. How does the CAD system operate?
5. What is the purpose of the CAM system? How does it operate?
6. What functions does the CIM system perform?
7. What does the CIM system represent?

7. Переведите текст 9A без словаря:

TEXT 9A

ПРОИЗВОДСТВО С КОМПЛЕКСНЫМ УПРАВЛЕНИЕМ ОТ ЭВМ

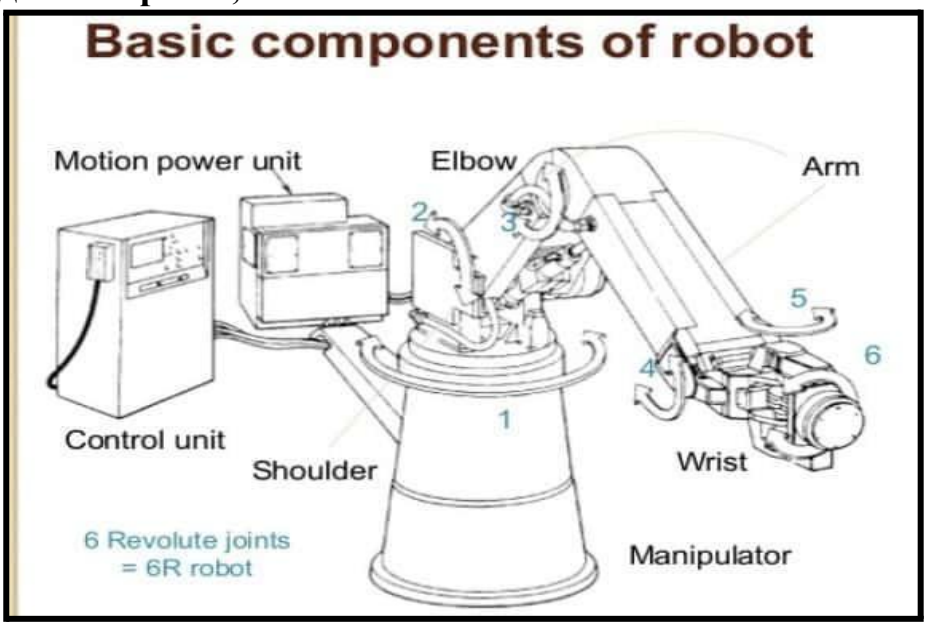
Начиная с 1970 г., производственные организации стали широко применять компьютеры. Такая технология получила название САПР/АСУП. Она включает в себя автоматизацию проектирования отдельных компонентов и конечного продукта, производственных операций, а также предпринимательских функций фирмы. Производство с комплексным управлением от ЭВМ включает в себя все инженерные функции САПР/АСУП, а также все предпринимательские функции управления предприятием. Вся информация компании обрабатывается компьютером и хранится в его базе данных, начиная с приёма заказов клиента и кончая погрузкой и доставкой продукта. Такая система представляет собой высший уровень автоматизации производства.

8. Подготовьте небольшое сообщение по теме:

1. The technology of CAD/CAM in manufacturing firms.
2. The characteristics of CAD/CAM technology.
3. The functions of the CAD system.
4. The functions of the CAM system.
5. The functions of the CIM system.

UNIT 10
КОМПОНЕНТЫ РОБОТОТЕХНИЧЕСКИХ СИСТЕМ

1. Рассмотрите устройство промышленного робота, назовите из каких компонентов он состоит. С какой частью тела человека ассоциируется данный робот, какие слова помогают нам это понять?



2. **Прочитайте текст и расскажите какие общие черты есть у роботов всех типов:**

TEXT 10

BASIC COMPONENTS OF ROBOTS

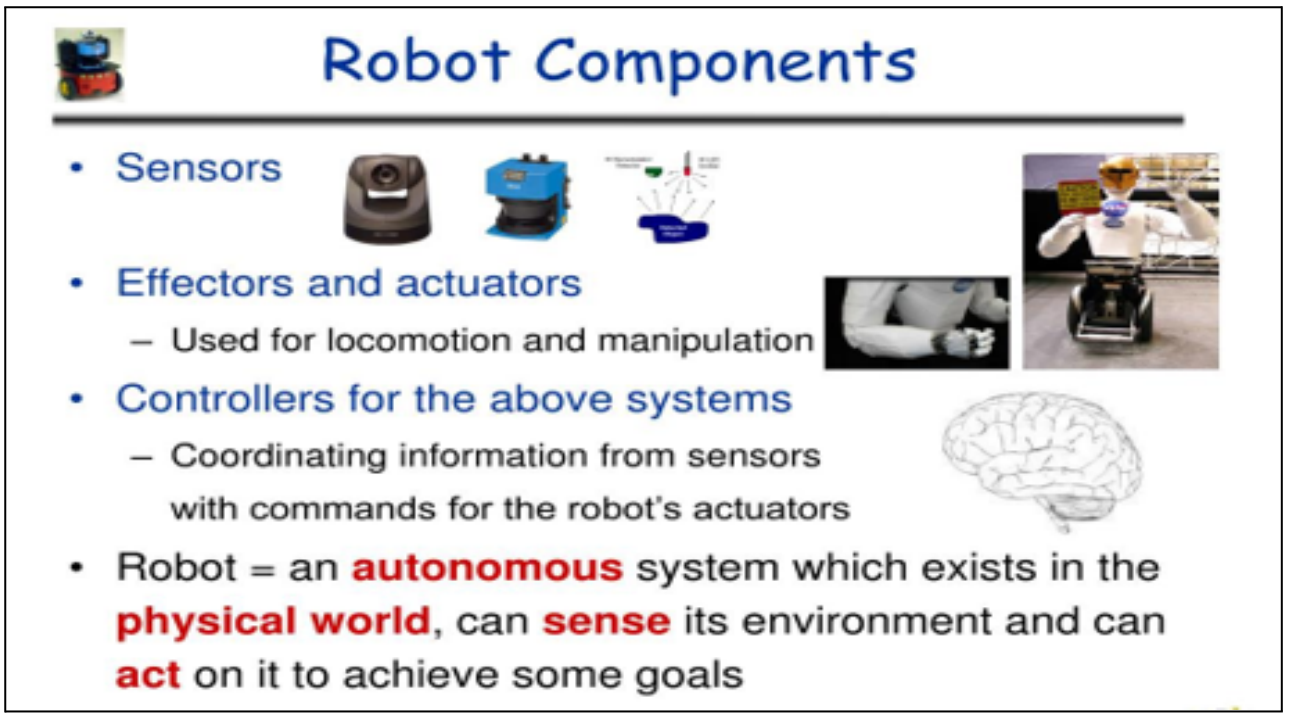
There are many types of robots; they are used in many different environments and for many different uses. Although being very diverse in application and form, they all share three basic similarities when it comes to their construction:

Robots have some kind of *mechanical construction*, a frame, form or shape designed to achieve a particular task. For example, a robot designed to travel across heavy dirt or mud, might use caterpillar tracks. The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it. Form follows function.

Robots have *electrical components* that power and control the machinery. For example, the robot with caterpillar tracks would need some kind of power to move the tracker treads. That power comes in the form of electricity, which will have to travel through a wire and originate from a battery, a basic electrical circuit. Even petrol powered machines that get their power mainly from petrol still require an electric current to start the combustion process which is why most petrol powered machines like cars, have batteries.

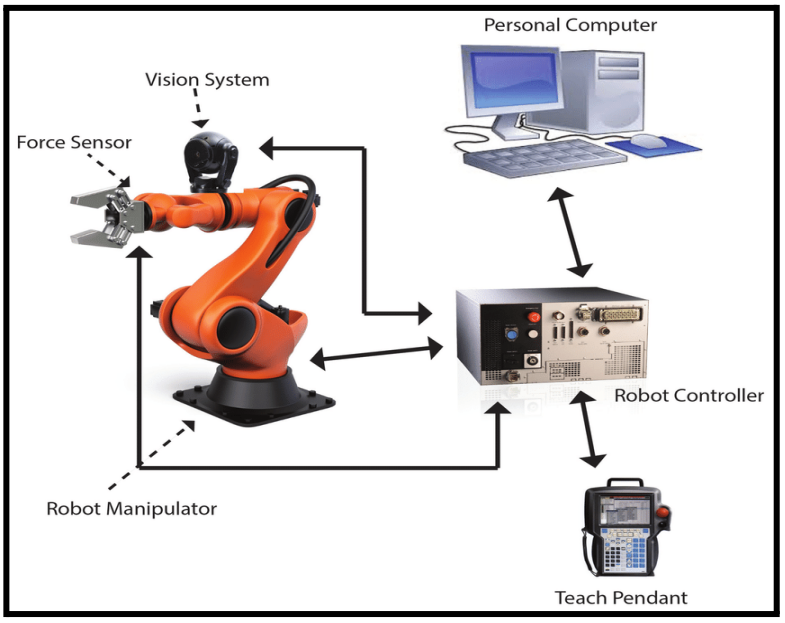
The electrical aspect of robots is used for movement (through motors), sensing (where electrical signals are used to measure things like heat, sound, position, and energy status) and operation (robots need some level of electrical energy supplied to their motors and sensors in order to activate and perform basic operations).

All robots contain some level of *computer programming code*. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a muddy road may have the correct mechanical construction and receive the correct amount of power from its battery, but would not go anywhere without a program telling it to move. Programs are the core essence of a robot, it could have excellent mechanical and electrical construction, but if its program is poorly constructed its performance will be very poor (or it may not perform at all).



There are three different types of robotic programs: remote control, artificial intelligence and hybrid. A robot with remote control programming has a preexisting set of commands that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more appropriate to view devices controlled primarily by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can determine reactions to objects and problems they encounter using their preexisting programming. Hybrid is a form of programming that incorporates both AI and RC functions in them.

4. Рассмотрите устройство промышленного робота-манипулятора. Опишите его (размер, внешний вид, из чего состоит, какую работу может выполнять):



ТЕКСТЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ РАБОТЫ

TEXT 11
ROBOTIC CONTROL SYSTEMS

The mechanical structure of a robot must be controlled to perform tasks. The control of a robot involves three distinct phases – perception, processing, and action (robotic paradigms). Sensors give information about the environment or the robot itself (e.g. the position of its joints or its end effector). This information is then processed to be stored or transmitted and to calculate the appropriate signals to the actuators (motors), which move the mechanical structure to achieve the required coordinated motion or force actions.

The processing phase can range in complexity. At a reactive level, it may translate raw sensor information directly into actuator commands (e.g. firing motor power electronic gates based directly upon encoder feedback signals to achieve the required torque/velocity of the shaft). Sensor fusion and internal models may first be used to estimate parameters of interest (e.g. the position of the robot's gripper) from noisy sensor data. An immediate task (such as moving the gripper in a certain direction until an object is detected with a proximity sensor) is sometimes inferred from these estimates. Techniques from control theory are generally used to convert the higher-level tasks into individual commands that drive the actuators, most often using kinematic and dynamic models of the mechanical structure.

At longer time scales or with more sophisticated tasks, the robot may need to build and reason with a "cognitive" model. Cognitive models try to represent the robot, the world, and how the two interact. Pattern recognition and computer vision can be used to track objects. Mapping techniques can be used to build maps of the world. Finally, motion planning and other artificial intelligence techniques may be used to figure out how to act. For example, a planner may figure out how to achieve a task without hitting obstacles, falling over, etc.

Modern commercial robotic control systems are highly complex, integrate multiple sensors and effectors, have many interacting degrees-of-freedom (DOF) and require operator interfaces, programming tools and real-time capabilities. They are oftentimes interconnected to wider communication networks and in many cases are now both IoT-enabled and mobile. Progress towards open architecture, layered, user-friendly and ‘intelligent’ sensor-based interconnected robots has emerged from earlier concepts related to Flexible Manufacturing Systems (FMS), and several 'open or 'hybrid' reference architectures exist which assist developers of robot control software and hardware to move beyond traditional, earlier notions of 'closed' robot control systems have been proposed.

TEXT 12

OPEN ARCHITECTURE CONTROLLERS

Open architecture controllers are said to be better able to meet the growing requirements of a wide range of robot users, including system developers, end users and research scientists, and are better positioned to deliver the advanced robotic concepts related to Industry 4.0.

In addition to utilizing many established features of robot controllers, such as position, velocity and force control of end effectors, they also enable IoT interconnection and the implementation of more advanced sensor fusion and control techniques, including adaptive control, Fuzzy control and Artificial Neural Network (ANN)-based control.

When implemented in real-time, such techniques can potentially improve the stability and performance of robots operating in unknown or uncertain environments by enabling the control systems to learn and adapt to environmental changes. There are several examples of reference architectures for robot controllers, and also examples of successful implementations of actual robot controllers developed from them.

One example of a generic reference architecture and associated interconnected, open-architecture robot and controller implementation was developed by Michael Short and colleagues at the University of Sunderland in the UK in 2000 (pictured right). The robot was used in a number of research and development studies, including prototype implementation of novel advanced and intelligent control and environment mapping methods in real-time.

UNIT 13

ИСПОЛЬЗОВАНИЕ РОБОТОТЕХНИКИ В АВТОМОБИЛЕСТРОЕНИИ

1. Изучите следующие слова и выражения:

1. handling — обращение
2. transfer — передача, перенос
3. pick up — брать, подбирать
4. arrangement — расположение
5. to utilize — утилизировать, находить применение
6. gripper — захват

7. to grasp— схватывать
8. spot welding — точечная сварка
9. arc welding — электродуговая сварка
10. spray painting — окраска распылением
11. frame — рама
12. spray-painting gun — распылитель краски
13. grinding — шлифование
14. polishing — полирование
15. spindle — шпиндель
16. hazardous — опасный
17. shift — смена

2. Прочитайте текст и переведите:

TEXT 13

ROBOTS IN AUTOMOBILE MANUFACTURING

Robots and robotic complexes nowadays are widely-used in manufacturing operations of the automobile industry. The applications of robots can be divided into three categories:

1. material handling
2. processing operations
3. assembly and inspection.

Material-handling is the transfer of material and loading and unloading of machines. Material-transfer applications require the robot to move materials or work parts from one to another. Many of these tasks are relatively simple: robots pick up parts from one conveyor and place them on another. Other transfer operations are more complex, such as placing parts in an arrangement that can be calculated by the robot. Machine loading and unloading operations utilize a robot to load and unload parts. This requires the robot to be equipped with a gripper that can grasp parts. As a rule, the gripper must be designed specifically for the particular part geometry.

In robotic processing operations, the robot manipulates a tool to perform a process on the work part. Examples of such applications include spot welding, continuous arc welding and spray painting. Spot welding of automobile bodies is one of the most common applications of industrial robots. The robot positions a spot welder against the automobile panels and frames to join them. Arc welding is a continuous process in which a robot moves the welding rod along the welding seam. Spray painting is the manipulation of a spray-painting gun over the surface of the object to be coated. Other operations in this category include grinding and polishing in which a rotating spindle serves as the robot's tool.

The third application area of industrial robots is assembly and inspection. The use of robots in assembly is expected to increase because of the high cost of manual labour. But the design of the product is an important aspect of robotic assembly. Assembly methods that are satisfactory for humans are not always suitable for robots. Screws and nuts are widely used for fastening in manual assembly, but the same operations are extremely difficult for an one-armed robot.

Inspection is another area of factory operations in which the utilization of robots is growing. In a typical inspection job, the robot positions a sensor with respect to the work part and determines whether the part answers the quality specifications.

In nearly all industrial robotic applications, the robot provides a substitute for human labour. There are certain characteristics of industrial jobs performed by humans that can be done by robots:

1. the operation is repetitive, involving the same basic work motions every cycle,
2. the operation is hazardous or uncomfortable for the human worker (for example: spray painting, spot welding, arc welding, and certain machine loading and unloading tasks),
3. the workpiece or tool is too heavy and difficult to handle,
4. the operation allows the robot to be used on two or three shifts.

3. Ответьте на следующие вопросы:

1. How are robots used in automobile manufacturing?
2. What is «material handling»?
3. What does a robot need to be equipped with to do loading and unloading operations?
4. What does a robot manipulate in a robotic processing operation?
5. What is the most common application of robots in automobile manufacturing?
6. What operations could be done by robot in the car manufacturing industry?
7. What are the main reasons to use robots in production?
8. How can robots inspect the quality of production?
9. What operations could be done by robots in hazardous or uncomfortable conditions for the human workers?

4. Переведите предложения на английский язык:

1. Роботизированные системы широко используются для выполнения трудных или опасных для человека задач в производстве.

2. Автоматизация широко используется в химической промышленности и автомобилестроении.

3. Станки с числовым программным управлением — хороший пример программируемой автоматизации.

4. Гибкая автоматизация делает возможным перепрограммирование оборудования.

5. Использование гибкой автоматизации делает возможным производство разнообразной продукции.

ТЕКСТ ДЛЯ САМОСТОЯТЕЛЬНОЙ РАБОТЫ

UNIT 14
ЭНЕРГОСБЕРЕГАЮЩЕЕ ПРОИЗВОДСТВО
ENERGY SAVING MANUFACTURING

Electricity is used to energize different kinds of equipment. We use electrical power for heating, cooling and lighting our houses, for cooking food, and for numerous devices and gadgets such TV-sets, computers and smartphones. Electrical power has become an essential necessity for modern society. Besides the obvious advantages that electrical power brings to our life there is a definite set of threats that this modern technology causes. The process of electricity generation on different kinds of power stations often is not so harmless to nature.

One of the most efficient but dangerous means of electricity generation is a nuclear power station. Though this is one of the most effective ways to generate electricity for the needs of society, the disastrous catastrophes in Chernobyl and Fukusima showed us how dangerous nuclear power is. The process of nature-friendly electricity generation has been developing greatly these days. Wind power, solar power and the power of the ocean are used to generate safe and cheap electricity that will be able to bring our life to the next level of evolution.

Manufacturing processes need a great consumption of electricity and water. While some facilities are mitigating their energy costs by installing on-site renewable generation, there are some more basic energy saving steps that everyone should investigate first. Here they are:

1. *Lighting*. Switching off lights remains one of the easiest ways to save on energy but it’s surprising how often lights are kept on, even when no one is in the lit area. This problem is compounded when employees go in and out of various buildings and work areas as they go about their duties. Incorporate automated lighting systems that make adjustments based on the room’s occupancy or daylight availability. You can also install day/night switches to automatically control outdoor

lighting. Additionally, install motion detector sensors that only switch lights on when the area is in use.

2. *Turn off and run equipment only when required.* Ensure you shut off machinery and equipment when not in use. Walking through your plant after-hours and ensuring equipment is powered down when not in use can result in significant savings over time. Specifically, reduce the operating pressure of your air compressor, check for leakages, and turn it off completely when not in use.

3. *Reduce closing door delay.* Automatic doors are a great way for manufacturing businesses, which require a cold room or refrigerated storage, to save on energy as they use sensors or a time delay to close the door. Energy savings can be made by reducing the close delay time frame on automatic doors, and limiting the frequency of cool room access as far as its practical.

4. *Clean and maintain equipment.* Regular cleaning and planned maintenance of your electrical and mechanical equipment will go a long way towards optimising its performance and lifespan, which can translate to energy efficiency savings. Performing regular maintenance on your equipment will prolong its lifespan.

5. *Air conditioning and heating.* According to Siemens, heating and cooling uses around 20 to 40 percent of a building's energy. Newer heating and cooling systems will be far more efficient than old ones, so it may be worth getting systems more than 10 years old replaced. Ensure your air conditioning and heating are set to the optimum points during the seasons. 'Setting the temperature to 25 degrees Celsius could cut your office's daily air-conditioning energy consumption by 18 per cent,' ABC reports.

6. *Insulation*. Insulation acts as a barrier against temperature shifts, making it much easier to keep the workplace warmer in winter and cooler in summer. By installing insulation in the roof, and walls of your workspace, you can reduce the amount of energy needed to maintain room temperature during heat loss and heat gain. This is one of the most practical and cost effective ways to make your facility more energy efficient.

7. *Shade windows and walls*. Often, the primary source of heat entering a building is via unprotected windows. The sun's radiant energy can generate the same local heat as a single bar radiator. Save energy by using fixed or adjustable shading, planting trees and vegetation or installing sun filters on the windows and walls of the workplace - especially industrial sheds - to protect it from radiant energy.

8. *Replace existing lights with LEDs.* LED bulbs use about a quarter of the energy to produce the same light as halogens and can last five to ten times longer. This makes them the logical lighting choice for energy savings, particularly when manufacturing workspaces need adequate and plentiful lighting.

9. *Use natural airflow*. Opening a window, or building door is a simple energy saving technique that can help reduce air conditioning and heating costs by relying on natural ventilation for climate control.

10. *Check air conditioning lines*. Make sure that pipe lagging on all refrigerant lines are intact as insulation is absolutely crucial, especially if the air conditioner is an

outdoor unit. If the air conditioner lines are not insulated, it's just absorbing heat from the environment and cooling the outside air instead of the building and vice versa in winter.

11. *Optimise appliances.* Depending on the appliances used in the workplace, you can optimise their settings to increase energy savings. For example, you can increase the drinks fridge temperature in the kitchen by one or two degrees to save energy without impacting employees or business.

12. *Make it collaborative, not top down.* Any energy savings initiative should be collaborative and involve all employees. If you want your employees to change their behaviour they need to do it when you're not in the room. So, communicate the real business costs. Let them know how it affects the bottom line, and regularly raise energy at toolbox meetings or monthly company meetups, to keep it top of mind. People will want to do their part if you let them.

By making small changes to your facility's lighting, air conditioning usage and switching off equipment when not in use, you can make a big difference to your yearly energy consumption. Once you've mastered the basics, you may consider energy efficiency measures such as power factor correction, or energy monitoring to gain a better understanding of which systems consume the most energy.

UNIT 15
РОБОТИЗИРОВАННАЯ СВАРКА

1. Изучите следующие слова и словосочетания:

1. an articulating robot - робот с шарнирными сочленениями, шарнирный робот
2. a rectilinear robot - робот с прямолинейной дорожкой
3. a rotating wrist - вращающийся запястный шарнир
4. axes (мн. ч. от axis) – оси перемещений; система координат
5. a linear movement - линейное перемещение
6. a rotating joint - шарнир, шарнирное соединение
7. irregularly shaped - неправильной формы, несимметричный
8. setting up – заправка, установка
9. a facility - устройство; установка; оборудование
10. a recalibration - повторная калибровка; повторная градуировка, переградуировка; повторная тарировка
11. to necessitate - делать необходимым; неизбежно влечь за собой
12. appropriate - подходящий, соответствующий; должный
13. a maintenance procedure - порядок технического обслуживания
14. interruption - задержка, приостановка, прерывание
15. production line - производственная линия; технологическая линия

2. Прочитайте интернациональные слова и переведите:

Robotic, mechanized, programmable, to automate, a robot, virtual, an electro-mechanical system, an agent, commercial, industrial, accuracy, a human, manufacturing, packing, transport, a laboratory, mass production, a process, gas, metal, equivalent, extensively, to command, a component, manipulator, controller, a design, a type, to be categorized, popular, to be engineered, monotony, a zone, to operate.

3. Составьте из предложенных слов предложения. Первое предложение послужит примером:

1. programmable/ welding/ the/ robotic/ tools/ mechanized/ is/ of/ use. *Robotic welding is the use of mechanized programmable tools.*
2. mechanical/ agent/ a/ is/ robot/ a/ artificial.
3. robotics/ welding/ new/ a/ application/ of/ robotic/ is.
4. in/ first/ into/ were/ US/ 1960/ introduced/ robots/ industry.

4. Прочитайте текст:

TEXT 15

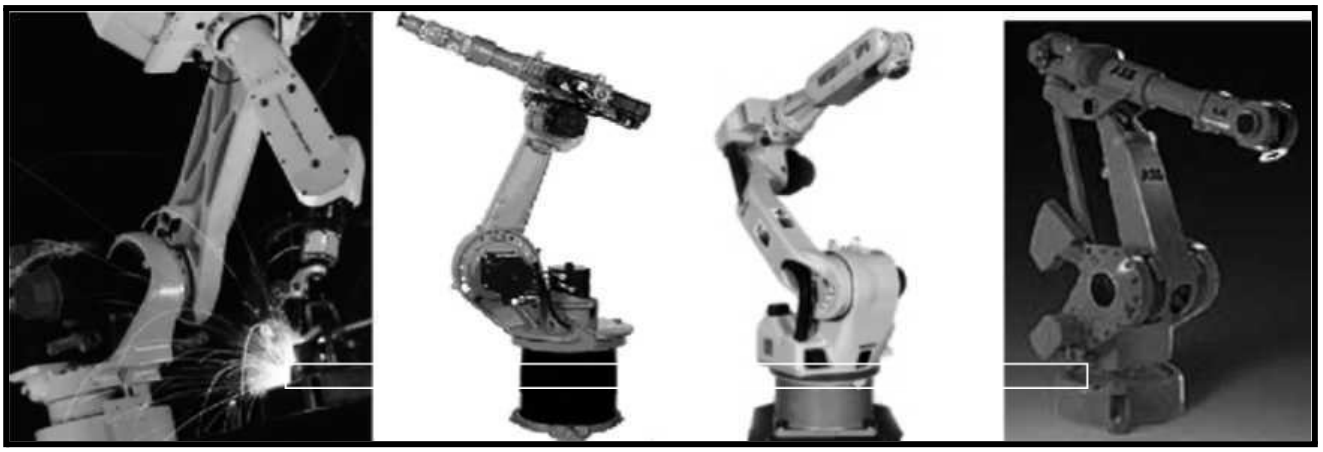
ROBOTIC WELDING

Robotic welding is the use of mechanized programmable tools (robots), which completely automate a welding process by both performing the weld and handling the part. A robot is a virtual or mechanical artificial agent. In practice, it is usually an electro-mechanical system. *"A robot is a reprogrammable multifunctional manipulator designed to move materials, parts, tools, or specialized devices, through variable programmed motions for the performance of a variety of tasks"* (Fu, Gonzalez, Lee, MacGraw Hill).

Commercial and industrial robots are in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs, which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods. Robotic welding is commonly used for resistance spot welding and arc welding in high production applications, such as the automotive industry. Processes such as gas metal arc welding, while often automated, are not necessarily equivalent to robotic welding, since a human operator sometimes prepares the materials to be welded.

Robotic welding is a relatively new application of robotics, even though robots were first introduced into US industry during the 1960s. The use of robots in welding did not take off until the 1980s, when the automotive industry began using robots

extensively for spot welding. Since then, both the number of robots used in industry and the number of their applications has grown greatly.



Robotic arc welding has begun growing quickly just recently, and already it commands about 20% of industrial robot applications. The major components of arc welding robots are the manipulator or the mechanical unit and the controller, which acts as the robot's "brain". The manipulator is what makes the robot move, and the design of these systems can be categorized into several common types, such as the SCARA robot and Cartesian coordinate robot, which use different coordinate systems to direct the arms of the machine.

There are two popular types of industrial welding robots. They are articulating robots and rectilinear robots. Robotics controls the movement of a rotating wrist in space. Rectilinear robots move in line in any of three axes (X, Y, Z). In addition to linear movement of the robot along axes there is a wrist attached to the robot to allow rotational movement. This creates a robotic working zone that is box shaped. Articulating robots employ arms and rotating joints. These robots move like a human arm with a rotating wrist at the end. This creates an irregularly shaped robotic working zone. There are many factors that need to be considered when setting up a robotic welding facility. Robotic welding needs to be engineered differently than manual welding.

A robotic welding system may perform more repeatedly than a manual welder because of the monotony of the task. However, robots may necessitate a regular recalibration or reprogramming. Robots should have the number of axes necessary to permit the proper range of motion. The robot arm should be able to approach the work from multiple angles. Robotic welding systems are able to operate continuously, provided appropriate maintenance procedures are adhered to. Continuous production line interruptions can be minimized with proper robotic system design.

5. Прочитайте предложения и поставьте T – если утверждение верное и F – если утверждение неверное:

1. Robotic welding is a manual process of welding.	
2. A robot is an electro-mechanical system.	
3. Robotic welding is commonly used for resistance spot welding and arc welding in high production applications.	
4. There are ten popular types of industrial welding robots.	
5. Rectilinear robots move in line in any of three axes.	
6. A wrist attached to the robot allows a linear movement.	
7. A robotic working zone is usually oval shaped.	
8. Articulating robots move like a human arm.	
9. Robotic welding is engineered as a manual welding.	
10.Robotic welding systems operate non continuously.	

6. Ответьте на вопросы:

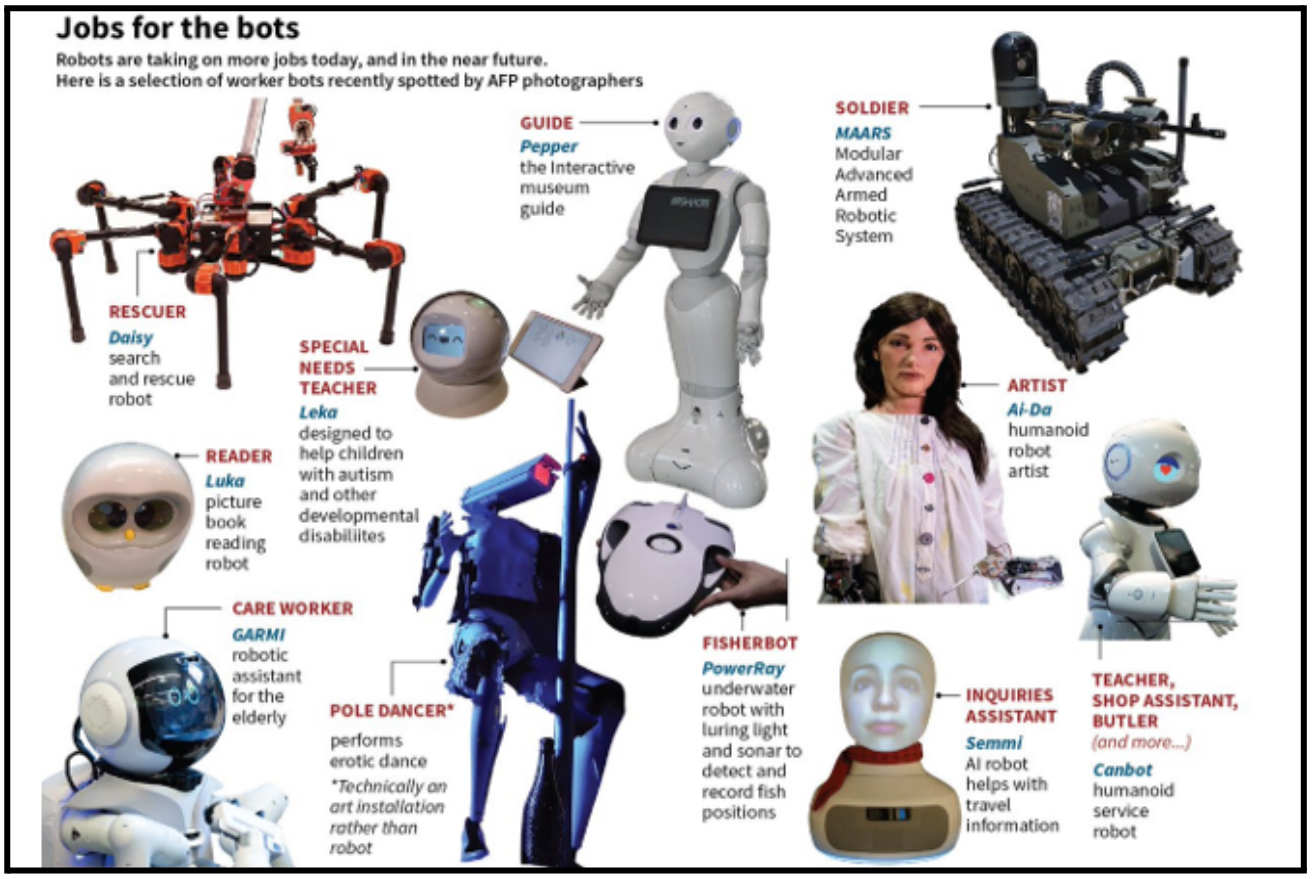
1. Robotic welding is the use of mechanized programmable tools (robots), isn't it?
2. What are the advantages of commercial and industrial robots? What is robotic welding commonly used for?
3. When and where were the first robots introduced and used?
4. What are the main parts of a robot?
5. The controller acts as the robot's "brain", doesn't it?
6. What are two popular types of industrial welding robots?
7. Does robotics control the movement of a rotating wrist in space?
8. What robots move like a human arm with a rotating wrist at the end?
9. Why is a robotic welding system more preferable in some welding processes than a manual welder?
10. What are the advantages and disadvantages of using robotic welding systems?

ТЕКСТЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ РАБОТЫ

TEXT 16

THE WORLD OF ROBOTICS INVENTIONS

Robotics engineering has been developing since the beginning of the new millennium. The annual Consumer Electronics Show (CES) expo in Las Vegas has traditionally been a major showcase for robotics breakthroughs each year.



Throughout the year, some trends have been emerging that provide insight to the direction in which robotics development is heading, including:

1) Domestic cleaning robots.
2) Companion robots.
3) Self-driving cars.
4) AI-powered health and wellbeing technology.

Let's look at ten of the most influential robotics inventions:

1. Ubtech Robotics Walker

The first bipedal robot to hit the commercial market, the Walker can be activated either by voice or by its touchscreen and serves as a robotic butler. This automated household helper can control your smart home, play music and dance, help schedule your calendar, patrol the home, and provide visual surveillance and motion detection. Although the Walker is currently armless, robotic arms that will further expand its usefulness are in development.

2. ForwardX CX-1 Robotics Suitcase

Frequent fliers among us will look on with envy at the hassle-saving potential of the CX-1. In essence it's a smart suitcase, packed full of features to take the effort out of carrying baggage. Powered wheels allow it to follow its owner autonomously, assisted by facial recognition so it can independently track users and sensors to detect and evade obstacles. There's even an anti-theft system in place where an alarm goes off on the user's smart wristband if the CX-1 goes beyond a certain distance.

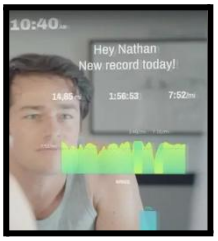
3. Somnox Sleep Robot

The body pillow gets a robotic upgrade with the Somnox sleep robot. This robotics device copies the feeling of sleeping next to another person by mimicking respiratory function to comfort the insomniacs amongst us. The idea is that the Somnox helps calm anxious sleepers by giving them a breathing pattern to mimic that helps them fall asleep faster. While the idea of clasping a "breathing" robot might be unsettling to some, the Somnox has already proven popular.

4. Boston Dynamics SpotMini

Boston Dynamics aren't known for deploying charm offensives. Much-viewed videos of their dog-like robots running and jumping have thrilled and terrified viewers in equal measure. Perhaps the most infamous, and impressive, of all is the SpotMini. It's able to run, jump, and even open doors. A video published earlier this year saw it carrying out tasks even in the face of mild human interference. Whether you feel it's a harbinger of the Skynet-style technological dystopia that's awaiting us or not, there's no denying the potential applications of the technology are mind-boggling.

5. Care OS Smart Mirror



Magic mirrors that talk back to you look like they won't just be a feature of fairy tales anymore. The Care OF mirror uses gesture controls and facial recognition to give skincare advice, as well as playing music and taking selfies. It's similar to other smartphone apps in development that use the camera to analyse users' dermatological health and provide advice about hydration and UV exposure, albeit on a much larger, domestic scale.

6. Robomart

The Robomart aims to make trips to the grocery store a thing of the past, with an AI-assisted autonomous vehicle that can bring you foodstuffs to order. Food retailers would lease the technology, leading to a Robomart fleet that can autonomously fulfill online grocery orders at a speed of up to 25 miles per hour. A pilot launch is scheduled this summer for California's Bay Area.

7. Sophia

Although there have been iterations in previous years, it was at the 2018 CES that Sophia really made a splash. The ongoing brainchild of Hong Kong's Hanson Robotics, Sophia is one of the most impressive displays of smart, empathetic artificial intelligence around. A milestone in humanoid robotics, Sophia's software is powered by Google, helping her hold developed conversations with humans that include smart retorts, philosophizing, and even the occasional well-timed joke. While commercial applications aren't yet clear, Sophia remains a truly stunning example of the possibilities offered by smart AI.

8. Aeolus Bot

The Aeolus Bot is bringing the robotics market closer than ever before to serious domestic applications. This home assistant bot is capable of vacuuming the floor, cleaning and putting away objects, and guarding the home. Running on Alexa, it can also help with shopping and organizing your diary. It's still in the prototype stage, but manufacturer Aeolus Robotics is confident that a commercial model is just on the horizon.

9. Kuri

Of all domestic assistant robots, Kuri looks to be the first in line for widespread adoption with pre orders already starting to ship. It's packed full of features, with the ability to answer questions and monitor your home thanks to an array of sensors. Simple in design and fun and useful around the house, it seems likely that Kuri's the first robot that's going to become a reality in everyday life.

These are just a handful of the innovations that 2018 has seen so far. With the year far from over, we're likely to see further eye-catching development in the

robotics inventions industry still to come. Events such as the global heats of the worldwide VEX Robotics Competition, BestRoboFest by Max Polyakov, Robotworld, and the Automation Technology Expo promise to be hotspots for announcing more breakthroughs in robotics engineering. If we see more designs unveiled like the above inventions, it looks like 2018 will be a milestone in the field of robotics development.

TEXT 17

1. Прочитайте текст, переведите и объясните, как вы представляете современного робота (его внешний вид, основные блоки, какие функции выполняет):

WHAT IS A ROBOT?

Robotics is the intersection of science, engineering and technology that produces machines, called robots, that substitute for (or replicate) human actions. Pop culture has always been fascinated with robots. R2-D2. Optimus Prime. WALL-E. These over-exaggerated, humanoid concepts of robots usually seem like a caricature of the real thing...or are they more forward thinking than we realize? Robots are gaining intellectual and mechanical capabilities that don't put the possibility of a R2-D2-like machine out of reach in the future.

A robot is the product of the robotics field, where programmable machines are built that can assist humans or mimic human actions. Robots were originally built to handle monotonous tasks (like building cars on an assembly line), but have since expanded well beyond their initial uses to perform tasks like fighting fires, cleaning homes and assisting with incredibly intricate surgeries. Each robot has a differing level of autonomy, ranging from human-controlled bots that carry out tasks that a human has full control over to fully-autonomous bots that perform tasks without any external influences.

As technology progresses, so too does the scope of what is considered robotics. In 2005, 90% of all robots could be found assembling cars in automotive factories. These robots consist mainly of mechanical arms tasked with welding or screwing on certain parts of a car. Today, we're seeing an evolved and expanded definition of robotics that includes the development, creation and use of bots that explore Earth's harshest conditions, robots that assist law-enforcement and even robots that assist in almost every facet of healthcare.

While the overall world of robotics is expanding, a robot has some consistent characteristics:

Robots all consist of some sort of mechanical construction. The mechanical aspect of a robot helps it complete tasks in the environment for which it's designed. For example, the Mars 2020 Rover's wheels are individually motorized and made of titanium tubing that help it firmly grip the harsh terrain of the red planet.

Robots need electrical components that control and power the machinery. Essentially, an electric current (a battery, for example) is needed to power a large majority of robots.

Robots contain at least some level of computer programming. Without a set of code telling it what to do, a robot would just be another piece of simple machinery. Inserting a program into a robot gives it the ability to know when and how to carry out a task.

We're really bound to see the promise of the robotics industry sooner, rather than later, as artificial intelligence and software also continue to progress. In the near future, thanks to advances in these technologies, robots will continue getting smarter, more flexible and more energy efficient. They'll also continue to be a main focal point in smart factories, where they'll take on more difficult challenges and help to secure global supply chains.

Though relatively young, the robotics industry is filled with an admirable promise of progress that science fiction could once only dream about. From the deepest depths of our oceans to thousands of miles in outer space, robots will be found performing tasks that humans couldn't dream of achieving alone.

2. **Напишите письмо другу, опираясь на следующую инструкцию:**

Write your pen-friend Jane a letter (100-120 words), using the following hints:

1. Начните письмо следующим образом:

Dear Jane,

I've just watched a TV series about robots, their past and future. Robots are so cool! They are able to replace humans in many kinds of jobs. If only they could do my homework…

2. Напишите что вы думаете о роботах и узнайте что думает по этому поводу ваш собеседник:

What job would you like a robot to do at your home? What else can robots be useful for? What films about robots have you watched? Do you like them?

3. Завершите свое письмо.

3. **Прочитайте текст, переведите и расскажите о двух технологиях, на которых основывается роботехника.**

INDUSTRIAL ROBOTICS

Industrial robotics is an automation technology that has received considerable attention since about 1960. This section will discuss the development of industrial robotics, the design of the robot manipulator, and the methods of programming robots.

Robotics is based on two related technologies: numerical control and teleoperators.

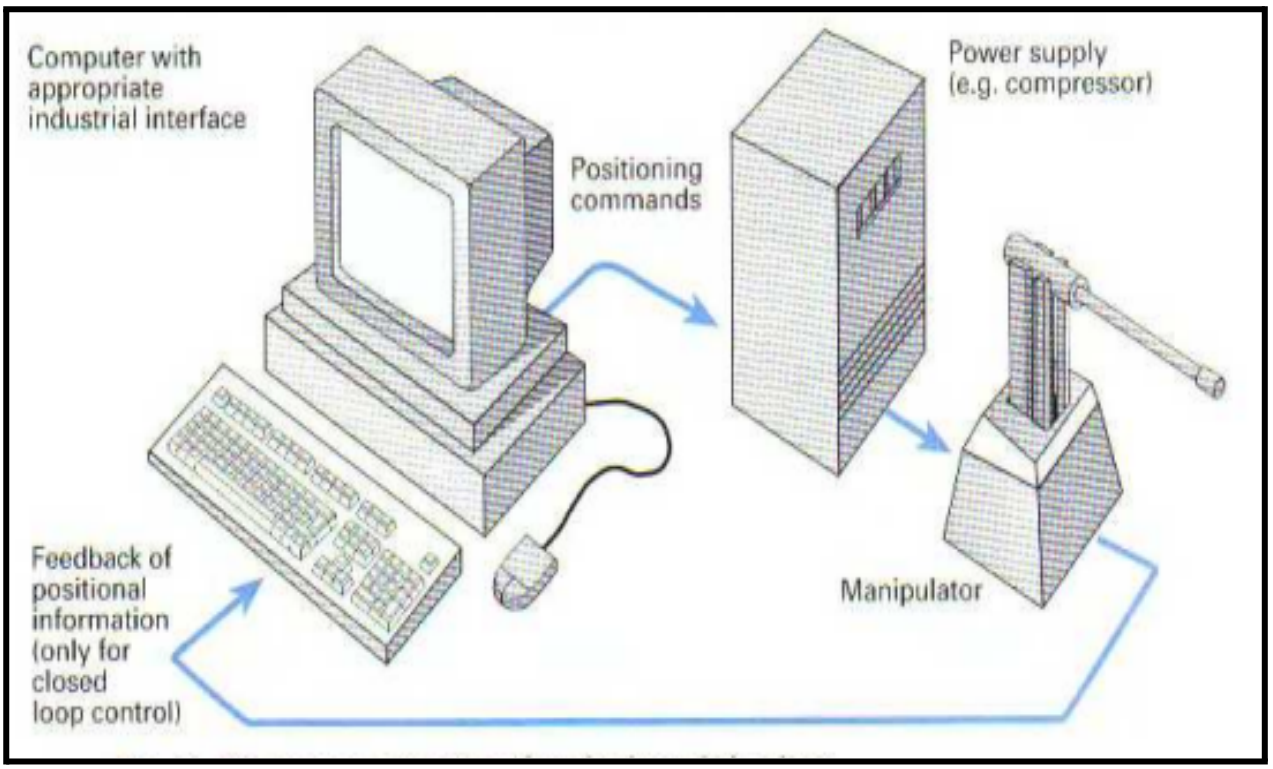
Numerical control (NC) is a method of controlling machine tool axes by means of numbers that have been coded on a punched paper tape or other media. It was developed during the late 1940s and early 1950s. The first numerical control machine tool was demonstrated in 1952 in the United States at the Massachusetts Institute of Technology (MIT[1]). The subsequent research at MIT led to the development of the APT (Automatically Programmed Tools) language for programming machine tools.

A teleoperator is a mechanical manipulator that is controlled by a human from a remote location. The initial work on the design of teleoperators can be traced to the handling of radioactive materials in the early 1940s. In a typical implementation, a human moves a mechanical arm and hand at one location, and these motions are duplicated by the manipulator at another location.

Industrial robotics can be considered a combination of numerical control and teleoperator technologies. Numerical control provides the concept of a programmable industrial machine, and teleoperator technology contributes the notion of a mechanical arm to perform useful work. The first industrial robot was installed in 1961 to unload parts from a die-casting operation. Its development was due largely to the efforts of the Americans George C. Devol, an inventor, and Joseph F. Engelberger, a businessman. Devol originated the design for a programmable manipulator, the U.S. patent for which was issued in 1961. Engelberger teamed with Devol to promote the use of robots in industry and to establish the first corporation in robotics – Unimation, Inc.

Note:

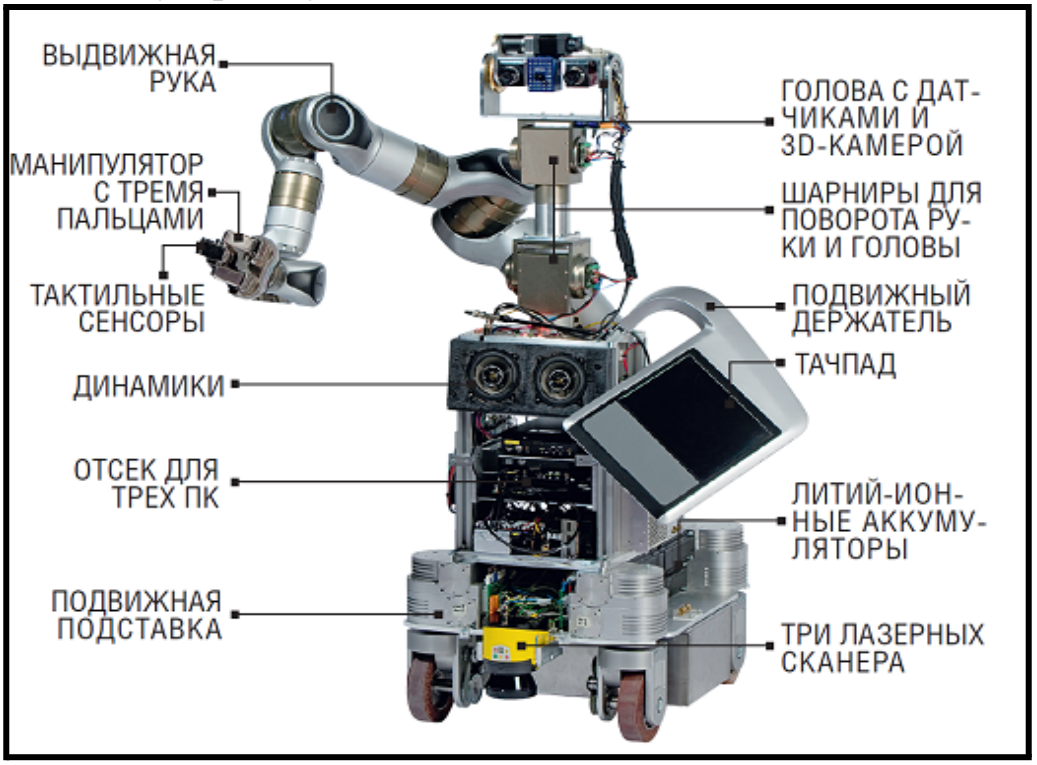
[1]MIT – Massachusetts Institute of Technology – Массачусетский технологический институт



Components of industrial robotic system

ПОДГОТОВКА К ЗАЧЕТУ

1. Рассмотрите устройство робота. Подберите английские эквиваленты к названиям частей робота. Опишите его (размер, внешний вид, из чего состоит, какую работу может выполнять):



2. Прочитайте текст, переведите его письменно и составьте реферат:

History of Mechatronics Engineering

Tetsura Mori was working for a Japanese company called Yaskawa Electric Corporation that was famous for building mechanical factory equipment.

At that time, Yaskawa Electric Corporation was using some electronic features for manufacturing mechanical equipment. Mori wanted to introduce a technical term for that new technology, so he combined the two technical words ‘mechanical’ and ‘electronics’ and created the new word “Mechatronics.”

In 1970, Yaskawa applied to make this word a registered brand and got the rights in 1973. But, at that time this term didn’t gain much popularity. After the 1980s, the term started gaining popularity because of its useful features.

Earlier, this term was based on only some electrical and electronic computers, but after the 1980s, the use of computer technology was integrated. The controlling and functioning of machines became much easier by use computer hardware and software. This allowed the start of manufacturing of a variety of products of any size with very high accuracy and comparatively low cost.

At the research and development level, mechatronics is classified into ten technical areas: Motion Control, Robotics, Automotive Systems, Intelligent Control, Actuators and Sensors, Modeling and Design, System Integration, Manufacturing, Micro Devices and Optoelectronics, and Vibration and Noise control.

Obviously, the design of future products will involve a combination of precision mechanical and electronic systems, and mechatronics will be the basis for all activities in products and production technology.

3. Прочитайте текст и расскажите о должностных обязанностях техника-мехатроника:

Some job responsibilities of a mechatronics engineer include:

1. Apply mechatronic or automated solutions to the transfer of material, components or finished goods.
2. Apply advanced control systems, which are usually computer-driven.
3. Apply electronic and mechanical processes and computers to tasks where the use of human labor may be dangerous (like underwater exploration, mining or forestry).
4. Build and test factory production lines introducing automation to improve existing processes.
5. Design and build completely new products by integrating various technologies, for example, developing robotic vehicles for underwater exploration.
6. Design, develop, maintain and manage high technology engineering systems for the automation of industrial tasks.

7. Develop new solutions to industrial problems using mechanical and electronic processes and computer technology.
8. Maintain and improve previous industrial and manufacturing processes and designs, for example, robotic lawn mowers and robot floor cleaners.

4. **Напишите сочинение-рассуждение (150 слов) на тему** «Robots are unable to replace a human in all jobs»:

The problem of automation and robotization has always aroused debates. Some people are convinced that robots will soon replace humans in all jobs. However, the others believe that ...

Вопросы:

1. What functions are robots able to perform?
2. What kinds of jobs do you think robots will be doing in the future?
3. What jobs are impossible to complete by robots? Why?
4. What do robots lack compared to humans?

Фразы-подсказки:

- to do simple actions
- to interact with the outer world
- to create
- to repair
- to make other robots
- to manage robots
- to understand figurative speech
- to build factories and houses in outer space
- to mine minerals on Mars
- to think like a human
- to make decisions
- to feel and produce emotional responses
- people, who are involved in creative jobs

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