МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

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

Строительно-политехнический колледж

МЕТОДИЧЕСКИЕ УКАЗАНИЯ

к учебному материалу на английском языке
для практических занятий и самостоятельной работы
по дисциплине "Иностранный язык в профессиональной деятельности"
для студентов специальности 15.02.10 Мехатроника и мобильная робототехника (по отраслям)
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

«25» 02. 2022 года Протокол № 6

Председатель педагогического совета СПК_____ Дегтев Д.Н.

2022

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ББК 81.2 Англ

Методические указания к учебному материалу на английском языке для практических занятий и самостоятельной работы по дисциплине Иностранный язык в профессиональной деятельности для студентов специальности 15.02.10 Мехатроника и мобильная робототехника (по отраслям) очной формы обучения строительно-политехнического колледжа/ ФГБОУ ВО «Воронежский государственный технический университет»; сост. Н.В. Аленькова, 2022. 32 с.

Методические указания содержат учебные тексты и задания для аудиторной работы. 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 3 курса.
Библиогр.: 7 назв.
Рецензент канд. филол. наук, доц. А.А. Падурец
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Печатается по решению редакционно-издательского совета Воронежского государственного технического университета

UNIT 1

1. Study the following words and word combinations of your active vocabulary:

1. gynoid — гиноид (разновидность андроида)
2. depiction - воспроизведение; отображение
3. autonomous — независимый; автономный; самоуправляющийся; саморегулируемый
4. die casting machine - прессовая формовочная машина; машина для литья под давлением
5. to lift - вынимать, поднимать
6. to stack - складывать в пачку; складывать в стопу;
7. to perform - выполнять;
8. accurately - точно;
9. to coin - выбивать (рисунок на поверхности металла)
10. assembly — сборка, монтаж, скрепление;
11. packing - расфасовка
12. packaging — монтаж, сборка, упаковывание;
13. surgery — хирургия;
14. weaponry — оружейное дело;

2. Find the Russian equivalents to the following words and word combinations:

1) Installed	A) Промышленного образца;
2) digitally operated	гражданского типа
3) consumer	B) подходящий
4) commercial	C) задействованный
5) widespread	D) подобный, похожий
6) employed	E) потребительский,
7) suitable	потребляющий
8) published	F) управляемый электроникой
9) similar	G) широко распространенный

	H) установленный, размещенный I) опубликованный

3. Read and translate the text:

HYSTORY OF ROBOTICS

In 1927 the Maschinenmensch ("machine-human") gynoid humanoid robot (also called "Parody", "Futura", "Robotrix", or the "Maria impersonator"), the first depiction of a robot ever to appear on film, was played by German actress Brigitte Helm in Fritz Lang's film Metropolis. In 1948 Norbert Wiener formulated the principles of cybernetics, the basis of practical robotics. The word robotics was derived from the word robot, which was introduced to the public by Czech writer Karel Capek in his play R.U.R. (Rossum's Universal Robots), which was published in 1920. The word robot comes from the Slavic word “robota”, which means “labour”. The play begins in a factory that makes artificial people called robots, creatures who can be mistaken for humans – similar to the modern ideas of androids. Karel Capek himself did not coin the word. He wrote a short letter in reference to an etymology in the Oxford English Dictionary in which he named his brother Josef Capek as its actual originator.

According to the Oxford English Dictionary, the word robotics was first used in print by Isaac Asimov, in his science fiction short story "Liar", published in May 1941 in Astounding Science Fiction. Asimov was unaware that he was coining the term; since the science and technology of electrical devices is electronics, he assumed robotics already referred to the science and technology of robots. In some of Asimov's other works, he states that the first use of the word robotics was in his short story “Runaround” (Astounding Science Fiction, March 1942). However, the original publication of "Liar!" predates that of "Runaround" by ten months,

so the former is generally cited as the word's origin. In 1942 Isaac Asimov formulated his Three Laws of Robotics.

Fully autonomous robots only appeared in the second half of the 20th century. The first digitally operated and programmable robot, the Unimate, was installed in 1961 to lift hot pieces of metal from a die casting machine and stack them. Commercial and industrial robots are widespread today and used to perform jobs more cheaply, or more accurately and reliably, than humans. They are also employed in jobs which are too dirty, dangerous, or dull to be suitable for humans. Robots are widely used in manufacturing, assembly, packing and packaging, transport, earth and space exploration, surgery, weaponry, laboratory research, safety, and the mass production of consumer and industrial goods.

4. Look through the following TABLE №1 and be ready to talk about automatic inventions and their significance.

TABLE №1

INVENTION OF ROBOT

Date	Significance and Robot Name	Inventor
Third century B.C. and earlier	One of the earliest descriptions of automata appears in the Lie Zi text, on a much earlier encounter between King Mu of Zhou (1023–957 BC) and a mechanical engineer known as Yan Shi, an 'artificer'. The latter allegedly presented the king with a life-size, human-shaped figure of his mechanical handiwork.	*Yan Shi*
First century A.D. and earlier	Descriptions of more than 100 machines and automata, including a fire engine, a wind organ, a coin-operated machine, and a steam-powered engine, in	*Ctesibius, Philo of Byzantium, Heron of*

	Pneumatica and Automata by Heron of Alexandria.	*Alexandria, and others*
c. 420 B.C.E	A wooden, steam propelled bird, which was able to fly.	*Archytas of Tarentum*
1206	Created early humanoid automata, programmable automaton band. Robot band, hand-washing automaton, automated moving peacocks.	*Al-Jazari*
1495	Designs for a humanoid robot Mechanical knight	*Leonardo da Vinci*
1738	Mechanical duck that was able to eat, flap its wings, and excrete. Digesting Duck	*Jacques de Vaucanson*
1921	First fictional automatons called "robots" appear in the play R.U.R. Rossum's Universal Robots	*Karel Capek*
1930s	Humanoid robot exhibited at the 1939 and 1940 World's Fairs Elektro Westinghouse	*Electric Corporation*
1948	Simple robots exhibiting biological behaviors.	*Elsie and Elmer William Grey Walter*
1956	First commercial robot, from the Unimation company founded by George Devol and Joseph Engelberger, based on Devol's patents Unimate	*George Devol*

1961	First installed industrial robot. Unimate	*George Devol*
1973	First industrial robot with six electromechanically driven axes Famulus	*KUKA Robot Group*
1974	The world's first microcomputer controlled electric industrial robot, IRB 6 from ASEA, was delivered to a small mechanical engineering company in southern Sweden. The design of this robot had been patented already 1972. IRB 6	*ABB Robot Group*
1975	Programmable universal manipulation arm, a Unimation product PUMA	*Victor Scheinman*

5. Make up 5 – 15 special questions to the information from the TABLE №1 (ex. 4, UNIT 1) as in the example:
   1. EXAMPLE:

A wooden, steam propelled bird, which was able to fly.	*Archytas of Tarentum*

Who was the first to invent a wooden, steam propelled bird, which was able to fly?

Who invented a wooden, steam propelled bird, which was able to fly?

When did Archytas of Tarentum invent a wooden, steam propelled bird, which was able to fly?

6. Answer the following questions, paying attention to the types of questions used, explain their usage:

1. Who was the first to formulate the principles of cybernetics in 1948?
2. Is cybernetics the basis of practical robotics or electrical devices?
3. Where does the word “robot” come from and what does it mean?
4. Where was the word “robot” first used in print according to the Oxford English Dictionary? Who did it?
5. In 1942 Isaac Asimov formulated his Three Laws of Robotics, didn't he?
6. Did fully autonomous robots only appear in the second half of the 20th century?
7. What was the first digitally operated and programmable robot, the Unimate, used for?
8. Commercial and industrial robots are widespread today and used to perform jobs more cheaply, or more accurately and reliably, than humans, aren't they?

Now, try to make up questions to this sentence:

Nowadays robots are also employed in jobs which are too dirty, dangerous for humans.
Общий*:*
Специальный*:*
Альтернативный:
Разделительный:
К подлежащему:

7. Write an annotation to the text “HYSTORY OF ROBOTICS”, using the plan on 30-32.

UNIT 2

1. Study the words:

1. environment - среда
2. diverse - разнообразный
3. to share — делить, разделять
4. frame – габарит, строение, структура
5. caterpillar tracks — гусеница, гусеничная цепь/ ход
6. solution — решение
7. to complete – выполнить, завершить
8. assigned — порученный, выделенный
9. machinery — машинное оборудование, механизм
10. tracker tread — гусеница; гусеничная цепь; обод
11. circuit — цепь, схема
12. sensing — распознавание, считывание, измерение, контроль, восприятие, обнаружение
13. computer programming code — компьютерный программный код
14. core essence — главная сущность
15. remote control — телемеханика, дистанционное регулирование
16. artificial intelligence — искусственный интеллект, «электронный мозг»
17. appropriate — подходящий, соответствующий
18. to determine — идентифицировать, вычислять,
19. to encounter – столкнуться, встретиться

2. Read the text and try to understand its main idea:

ROBOTICS ASPECTS

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:

1. Robots all 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.

2. Robots have electrical components which 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 gas powered machines that get their power mainly from gas still require an electrical current to start the gas using process which is why most gas 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)

3. 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 programing 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.

3.Answer the following questions:

1. Are there many types of robots?
2. Are robots applied in many different environments and for many different uses?
3. What features do all the robots have?
4. Does form follow function?
5. Robots have electrical components which power and control the machinery, don't they?
6. Does the power come to robot in the form of electricity from a battery or from the power source?
7. What is the electrical aspect of robots used for?
8. What are the main purposes of computer programming code in robots?
9. Can we call programs the core essence of a robot?

4. Speak about “Three different types of robotic programs”, using the following plan:

1. A robot with remote control programing.
2. A robot with artificial intelligence.
3. A robot with hybrid programming.

5. Read the text, translate it without a dictionary and get ready to retell it:

ROBOTICS

Robotics is the branch of mechanical engineering, electrical engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing.

These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behavior, and/or cognition. Many of today's robots are inspired by nature contributing to the field of bio-inspired robotics.

The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, robotics has been often seen to mimic human behavior, and often manage tasks in a similar fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Many robots do jobs that are hazardous to people such as defusing bombs, mines and exploring shipwrecks.

6. Summarize all the information given in the tasks №2 and №5, write an annotation to the topic “ROBOTICS ASPECTS”, using the plan on pages 30-32.

7. Fill in the gaps with the proper word:

1. _____can take the place of humans in dangerous environments.
2. Today, robotics is a rapidly growing _____.
3. Robots are used in many different _____ and for many different _____.
4. Hybrid is a form of _____ that incorporates both AI and RC functions.

UNIT 3

1. Study the words, choose any 5 of them and use them in the sentences of your own:

1. Computer vision – машинное/ техническое зрение
2. image data — видеоинформация, видеоданные
3. sequence — порядок, последовательность
4. image sensor — датчик изображения
5. to detect — обнаруживать, распознавать
6. solid-state physics — физика твердого тела
7. to propagate — проходить, пропускать
8. sense of depth — ощущение глубины
9. to adjust to variations – приспосабливаться к изменениям
10. complexity — сложность
11. effector — исполнительный механизм
12. manipulator — механическая рука робота, манипулятор
13. to allow – помогать, позволять
14. to perform - выполнять
15. range - диапозон

2. Translate the following sentences:

1. “Машинное зрение“ - это технология видения машины.
2. Датчики были сконструированы с помощью твердо-тельной физики.
3. Подобно глазам человека, «глаза» робота должны приспосабливаться к изменениям освещения.
4. Роботы манипулируют предметами: поднимают их, переносят с места на место, устанавливают, переворачивают и тд.
5. На механической руке робота можно устанавливать разные исполнительные механизмы.

6. Заменяемые исполнительные механизмы могут выполнять большой диапазон задач.
7. “Машинное зрение“ помогает роботу получать информацию из образов и картинок.

3. Read the text and find the main idea of each paragraph:

COMPUTER VISION

Computer vision is the science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences and views from cameras.

In most practical computer vision applications, the computers are pre-programmed to solve a particular task, but methods based on learning are now becoming increasingly common.

Computer vision systems rely on image sensors which detect electromagnetic radiation which is typically in the form of either visible light or infra-red light. The sensors are designed using solid-state physics. The process by which light propagates and reflects off surfaces is explained using optics. Sophisticated image sensors even require quantum mechanics to provide a complete understanding of the image formation process. Robots can also be equipped with multiple vision sensors to be better able to compute the sense of depth in the environment. Like human eyes, robots' "eyes" must also be able to focus on a particular area of interest, and also adjust to variations in light intensities.

There is a subfield within computer vision where artificial systems are designed to mimic the processing and behavior of biological system, at different levels of complexity. Also, some of the learning-based methods developed within computer vision have their background in biology.

Robots need to manipulate objects; pick up, modify, destroy, or otherwise have an effect. Thus the "hands" of a robot are often referred to as end effectors, while the "arm" is referred to as a manipulator. Most robot arms have replaceable effectors, each allowing them to perform some small range of tasks. Some have a fixed manipulator which cannot be replaced, while a few have one very general purpose manipulator, for example a humanoid hand.

4. Answer the following questions:

1. Is computer vision concerned with the theory behind artificial systems that extract information from images?
2. In most practical computer vision applications, the computers are pre-programmed to solve a particular task, aren't they?
3. Do computer vision systems rely on image sensors or eyes?
4. Does an image sensor detect electromagnetic radiation or thermal emission?
5. What do image sensors require to provide a complete understanding of the image formation process?
6. What can be equipped with multiple vision sensors to compute the sense of depth in the environment?
7. Do some robots have a fixed manipulator which cannot be replaced?

5. Write an annotation to the text “Computer vision”, using the plan on pages 30-32.

6. Find in the text synonyms and antonyms to the following words:

Synonyms	**Antonyms**
Subject – d.....	Absorption – r.....
Picture – i.....	Natural – a.....
Carry out – to p.....	Decreasingly – i.....

UNIT 4

1. Study the words:

1. distinct – отдельный, раздельный, индивидуальный
2. perception — восприятие
3. joint — соединение, шарнир
4. to transmit — передавать
5. actuator — привод, исполнительный механизм
6. raw — сырой, только полученный
7. to estimate — оценивать
8. gripper — захват
9. to convert — преобразовать
10. pattern recognition — распознание образов
11. to track — отслеживать
12. mapping technique — методы картирования, технология отображения
13. motion planning — программирование перемещений, планирование движений
14. sensor fusion — сбор и обобщение данных, полученных от средств обнаружения; сочетание различных датчиков

2. Fill in the gaps, using the words from the box:

recognition; perception; techniques; raw; structure; track; convert

1. The mechanical _____ of a robot performs tasks.
2. The control of a robot involves three distinct phases – _____, processing and action.
3. It may translate_____sensor information directly into actuator commands.
4. Techniques from control theory_____the task into commands that drive the actuators.
5. Pattern___and computer vision can be used to___objects.

6. Mapping _____can be used to build maps of the world.

3. Read the following text and translate it, using the dictionary:

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 mechanism.

The processing phase can range in complexity. At a reactive level, it may translate raw sensor information directly into actuator commands. Sensor fusion 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) is inferred from these estimates. Techniques from control theory convert the task into commands that drive the actuators.

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 they 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.

4. Translate from Russian into English with/without a dictionary:

СИСТЕМА УПРАВЛЕНИЯ РОБОТОМ

Промышленный робот — автономное устройство, состоящее из механического манипулятора и перепрограммируемой системы управления, которое применяется для перемещения объектов в пространстве в различных производственных процессах.

Промышленные роботы способны заменить человека там, где трудные условия работы и требуется тяжелый физический труд. Они представляют собой перепрограммируемую автоматическую машину, способную выполнять двигательные функции по перемещению предметов производства или технологической оснастки.

Современные роботы функционируют на основе принципов обратной связи, подчинённого управления и иерархичности системы управления роботом. Система управления руководит общим поведением робота, расчётом необходимой траектории движения манипулятора, поведением отдельных его приводов.

5. Answer the following questions:

1. Must the mechanical structure of a robot be controlled to perform tasks?
2. What three phases does the control of a robot involve?
3. What gives information about the environment or the robot itself?
4. Sensor fusion is used to estimate parameters of interest from noisy sensor data, isn't it?
5. Do techniques from control theory convert the task into commands that drive the actuators?
6. What do the cognitive models try to represent?
7. What can pattern recognition and computer vision be used for?
8. What can mapping techniques be used for?
9. What can motion planning and other artificial intelligence be used for?

6. Write an annotation to the text “Control systems”, using the plan on pages 30-32.

UNIT 5

1. Skim the following text and tell us about the main content of this text:

COMPUTER CONTROL

Computers can perform both **sequential control** and feedback control, and typically a single computer will do both in an industrial application. **Programmable logic controllers** (PLCs) are a type of special purpose microprocessor that replaced many hardware components such as timers and drum sequencers used in relay logic type systems. General purpose process control computers have increasingly replaced stand alone controllers, with a single computer able to perform the operations of hundreds of controllers. Process control computers can process data from a network of PLCs, instruments and controllers in order to implement typical (such as PID) control of many individual variables or, in some cases, to implement complex control algorithms using multiple inputs and mathematical manipulations. They can also analyze data and create real time graphical displays for operators and run reports for operators, engineers and management.

Control of an **automated teller machine** (ATM) is an example of an interactive process in which a computer will perform a logic derived response to a user selection based on information retrieved from a networked database. The ATM process has similarities with other online transaction processes. The different logical responses are called scenarios. Such processes are typically designed with the aid of use cases and flowcharts, which guide the writing of the software code.

Words and expressions:

sequential control – управление последовательностью действий

pogrammable logic controllers – программируемый коммандоаппарат

automated teller machine — автоматизированный кассовый аппарат; банкомат

2. Study the words and use them in the sentences of your own:

1. steering — удержание на курсе, управление
2. intervention — вмешательство
3. accuracy — корркткность, правильность, аккуратность, точность
4. precision — точность
5. feedback controller — автоматический регулятор
6. household appliance — бытовой электроприбор
7. sequence control – управление последовательностью действий
8. adjustment — настраивание
9. measurement — измерение
10. HVAC – теплохладотехника; система управления отоплением, вентиляцией и кондиционированием

3. Read the text and get ready to answer the questions after the text.

AUTOMATION AND AUTOMATIC CONTROL

Automation or automatic control, is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated. The greatest benefit of automation is that it saves labor; however, it is also used

to save energy and materials and to improve quality, accuracy and precision.

The term automation, inspired by the earlier word automatic (coming from automaton), was not widely used before 1947, when General Motors established the automation department. It was during this time that industry was rapidly adapting feedback controllers, which were introduced in the 1930s. Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic, and computers, usually in combination. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques.

One of the simplest types of control is on-off control. An example is the thermostats used on household appliances. Electromechanical thermostats used in HVAC may only have had provision for on/off control of heating or cooling systems. Electronic controllers may add multiple stages of heating and variable fan speed control. Sequence control, in which a programmed sequence of discrete operations is performed, often based on system logic that involves system states. An elevator control system is an example of sequence control.

The advanced type of automation that revolutionized manufacturing, aircraft, communications and other industries, is feedback control, which is usually continuous and involves taking measurements using a sensor and making calculated adjustments to keep the measured variable within a set range.

4. Answer the questions:

1. Automatic control is the use of various control systems for operating equipment, isn't it?
2. What is the greatest benefit of automation?
3. By what means has automation been achieved?
4. What is one of the simplest types of control?
5. Electromechanical thermostats used in HVAC control heating or cooling systems, don't they?

6. What is the advanced type of automation that revolutionized manufacturing, aircraft, communications and other industries?

5. Write an annotation to the text “Automation and automatic control”, using the plan on pages 30-32.

UNIT 6

1. Study the following words and word combinations:

1. sail – крыло ветряной мельницы
2. centrifugal governor — центробежный регулятор скорости
3. millstone — жерновой камень, бегуны, жерновая мельница
4. in response to – в ответ на, под влиянием чего-либо
5. fluctuate - изменять, переливать, перетекать
6. heat load — тепловой поток
7. oscillation — колебание, вибрирование
8. as a consequence — как следствие
9. cut-off timing – момент отключения двигателя
10. governor — управляющее устройство; автоматическое устройство
11. electronic amplifier — электронный усилитель

2. Read the following text and try to understand its main idea:

FIRST AUTOMATED DEVICES (part 1)

The earliest feedback control mechanism was used to tent the sails of windmills. It was patented by Edmund Lee in 1745. The centrifugal governor, which dates to the last quarter of the 18th century, was used to adjust the gap between millstones. The centrifugal governor was also used in the automatic flour mill

developed by Oliver Evans in 1785, making it the first completely automated industrial process. The governor was adapted by James Watt for use on a steam engine in 1788 after Watt's partner Boulton saw one at a flour mill Boulton & Watt were building.

The governor could not actually hold a set speed; the engine would assume a new constant speed in response to load changes. The governor was able to handle smaller variations such as those caused by fluctuating heat load to the boiler. Also, there was a tendency for oscillation whenever there was a speed change. As a consequence, engines equipped with this governor were not suitable for operations requiring constant speed, such as cotton spinning.

Several improvements to the governor, plus improvements to valve cut-off timing on the steam engine, made the engine suitable for most industrial uses before the end of the 19th century. Advances in the steam engine stayed well ahead of science, both thermodynamics and control theory.

The governor received relatively little scientific attention until James Clerk Maxwell published a paper that established the beginning of a theoretical basis for understanding control theory. Development of the electronic amplifier during the 1920s, which was important for long distance telephony, required a higher signal to noise ratio, which was solved by negative feedback noise cancellation. This and other telephony applications contributed to control theory. Military applications during the Second World War that contributed to and benefited from control theory were fire-control systems and aircraft controls. The word "automation" itself was coined in the 1940s by General Electric. The so-called classical theoretical treatment of control theory dates to the 1940s and 1950s.

3. Answer the following questions:

1. Was the earliest feedback control mechanism used to tent the sails of windmills?

2. What was also used in the automatic flour mill in 1785?

3. The governor was able to handle smaller variations as caused by fluctuating heat load to the boiler, wasn't it?

4. What made the engine suitable for most industrial uses before the end of the 19th century?

5. What systems were contributed to and benefited from control theory?

UNIT 7

1. Study the following words and word combinations:

1. relay logic — релейно-контакторная логическая схема
2. central control room — центральный пункт управления
3. chart — технологическая карта
4. to plot data — представлять данные графически
5. valve – клапан двигателя
6. deviation - отклонение
7. set point - заданная позиция
8. to offset — сбалансировать, корректировать
9. productivity gains — повышение производительности
10. refinery — нефтеперегонный завод
11. computer hardware — аппаратное обеспечение компьютера

2. Choose any 5-10 words and expressions from Task 1 (page 22) and Task 1 (page 24) and make up sentences of your own.

3. Read the following text and try to understand its main idea:

FIRST AUTOMATED DEVICES (part 2)

Relay logic was introduced with factory electrification, which underwent rapid adaption from 1900 though the 1920s. Central electric power stations were also undergoing rapid growth and operation of new high pressure boilers, steam turbines and electrical substations created a large demand for instruments and controls.

Central control rooms became common in the 1920s, but as late as the early 1930s, most process control was on-off. Operators typically monitored charts drawn by recorders that plotted data from instruments. To make corrections, operators manually opened or closed valves or turned switches on or off. Control rooms also used color coded lights to send signals to workers in the plant to manually make certain changes.

Controllers, which were able to make calculated changes in response to deviations from a set point rather than on-off control, began being introduced in the 1930s. Controllers allowed manufacturing to continue showing productivity gains to offset the declining influence of factory electrification.

In 1959 Texaco's Port Arthur refinery became the first chemical plant to use digital control. Conversion of factories to digital control began to spread rapidly in the 1970s as the price of computer hardware fell.

4. Find some information in the text "First automated devices" Part 1 and Part 2 and talk about the following mechanisms and systems:

1. feedback control mechanism
2. governor
3. electronic amplifier
4. relay logic
5. controller

5. Read the following extract, find, underline and translate the key words, try to retell this text in English:

Автоматизация производства — это процесс в развитии машинного производства, при котором функции управления и контроля, ранее выполнявшиеся человеком, передаются приборам и автоматическим устройствам.

Введение автоматизации на производстве позволяет значительно повысить производительность труда и качество выпускаемой продукции, сократить долю рабочих, занятых в различных сферах производства.

До внедрения средств автоматизации замещение физического труда происходило посредством механизации основных и вспомогательных операций производственного процесса. Интеллектуальный труд долгое время оставался не механизированным (ручным).

В настоящее время многие операции физического и интеллектуального труда становятся объектом механизации и автоматизации.

6. Write an annotation to the text “First automated devices” Part 1 and Part 2, using the plan on pages 30-32.

UNIT 8

TEXTS FOR HOME READING

SEQUENTIAL CONTROL AND LOGICAL SEQUENCE OR SYSTEM STATE CONTROL

Sequential control may be either to a fixed sequence or to a logical one that will perform different actions depending on various system states. An example of an adjustable but otherwise fixed sequence is a timer on a lawn sprinkler.

States refer to the various conditions that can occur in a use or sequence scenario of the system. An example is an elevator, which uses logic based on the system state to perform certain actions in response to its state and operator input. For example, if the operator presses the floor n-button, the system will respond depending on whether the elevator is stopped or moving, going up or down, or if the door is open or closed, and other conditions.

An early development of sequential control was relay logic, by which electrical relays engage electrical contacts which either start or interrupt power to a device. Relays were first used in telegraph networks before being developed for controlling other devices, such as when starting and stopping industrial-sized electric motors or opening and closing solenoid valves.

Using relays for control purposes allowed event-driven control, where actions could be triggered out of sequence, in response to external events. These were more flexible in their response than the rigid single-sequence cam timers. More complicated examples involved maintaining safe sequences for devices such as swing bridge controls, where a lock bolt needed to be disengaged before the bridge could be moved, and the lock bolt could not be released until the safety gates had already been closed.

The total number of relays, cam timers and drum sequencers can number into the hundreds or even thousands in some factories. Early programming techniques and languages were needed to make such systems manageable, one of the first being ladder logic, where diagrams of the interconnected relays resembled the rungs of a ladder. Special computers called programmable logic controllers were later designed to replace these collections of hardware with a single, more easily re-programmed unit.

In a typical hard wired motor start and stop circuit (called a control circuit) a motor is started by pushing a "Start" or "Run" button that activates a pair of electrical relays. The "lock-in" relay locks in contacts that keep the control circuit energized when the push button is released. (The start button is a normally open contact

and the stop button is normally closed contact.) Another relay energizes a switch that powers the device that throws the motor starter switch (three sets of contacts for three phase industrial power) in the main power circuit. (Note: Large motors use high voltage and experience high in-rush current, making speed important in making and breaking contact. This can be dangerous for personnel and property with manual switches.) All contacts are held engaged by their respective electromagnets until a "stop" or "off" button is pressed, which de-energizes the lock in relay.
Commonly interlocks are added to a control circuit. Suppose that the motor in the example is powering machinery that has a critical need for lubrication. In this case an interlock could be added to insure that the oil pump is running before the motor starts. Timers, limit switches and electric eyes are other common elements in control circuits.

Solenoid valves are widely used on compressed air or hydraulic fluid for powering actuators on mechanical components. While motors are used to supply continuous rotary motion, actuators are typically a better choice for intermittently creating a limited range of movement for a mechanical component, such as moving various mechanical arms, opening or closing valves, raising heavy press rolls, applying pressure to presses.

SIGNIFICANT APPLICATIONS

The automatic telephone switchboard was introduced in 1892 along with dial telephones. By 1929, 31.9% of the Bell system was automatic. Automatic telephone switching originally used vacuum tube amplifiers and electro-mechanical switches, which consumed a large amount of electricity. Call volume eventually grew so fast that it was feared the telephone system would consume all electricity production, prompting Bell Labs to begin research on the transistor.

The logic performed by telephone switching relays was the inspiration for the digital computer.

The first commercially successful glass bottle blowing machine was an automatic model introduced in 1905. The machine, operated by a two man crew working 12-hour shifts, could produce 17,280 bottles in 24 hours, compared to 2,880 bottles made by a crew of six men and boys working in a shop for a day. The cost of making bottles by machine was 10 to 12 cents per gross compared to $1.80 per gross by the manual glassblowers and helpers.

Sectional electric drives were developed using control theory. Sectional electric drives are used on different sections of a machine where a precise differential must be maintained between the sections. In steel rolling, the metal elongates as it passes through pairs of rollers, which must run at successively faster speeds. In paper making the paper sheet shrinks as it passes around steam heated drying arranged in groups, which must run at successively slower speeds. The first application of a sectional electric drive was on a paper machine in 1919. One of the most important developments in the steel industry during the 20th century was continuous wide strip rolling, developed by Armco in 1928.

Before automation many chemicals were made in batches. In 1930, with the widespread use of instruments and the emerging use of controllers, the founder of Dow Chemical Co. was advocating continuous production.

Self-acting machine tools that displaced hand dexterity so they could be operated by boys and unskilled laborers were developed by James Nasmyth in the 1840s. Machine tools were automated with Numerical control (NC) using punched paper tape in the 1950s. This soon evolved into computerized numerical control (CNC).

Today extensive automation is practiced in practically every type of manufacturing and assembly process. Some of the larger processes include electrical power generation, oil refining, chemicals, steel mills, plastics, cement plants, fertilizer plants, pulp

and paper mills, automobile and truck assembly, aircraft production, glass manufacturing, natural gas separation plants, food and beverage processing, canning and bottling and manufacture of various kinds of parts. Robots are especially useful in hazardous applications like automobile spray painting. Robots are also used to assemble electronic circuit boards. Automotive welding is done with robots and automatic welders are used in applications like pipelines.

APPENDIX A

HOW TO WRITE AN ANNOTATION

Аннотирование - это вторичная обработка письменной информации. Для того чтобы зафиксировать краткое содержание произведения, пишется аннотация. Аннотация (Abstract или Summary) - это краткая справка о статье, патенте, книге, справочнике с точки зрения содержания. При аннотировании печатный материал излагается в предельно сжатой форме. Это процесс свертывания (сжатия) информации с очень большим уменьшением по отношению к оригиналу (до 1/10 его части).

Аннотации бывают описательные, справочные, реферативные, рекомендательные и критические. Остановимся лишь на описательных аннотациях, так как умение составлять их необходимо студентам в учебном процессе для обработки печатной информации на иностранном и русском языках и при оформлении записок к дипломным проектам. Специалисты и ученые обязаны уметь писать аннотации к своим научным статьям, докладам для конференций, на книги и т. д.

Описательная аннотация состоит из трех частей:

1. Справка к аннотации. В ней указываются следующие данные: автор; название работы на английском языке, перевод названия; количество страниц, таблиц, рисунков, ссылок на использованную литературу; на каком

языке написана работа. Кроме того, для журнала - его название на английском языке, номер и год издания; для патентов - номер патента и страна патентования; для каталогов - фирма, выпустившая данный каталог; для книг, монографий, учебников - название издательства.

2. Основная часть должна отражать перечень наиболее характерных положений по содержанию работы.

3. Заключительная часть. В этой части должен быть общий вывод автора работы или указание на один какой-то вопрос, которому в работе уделено особое внимание, а также рекомендация, для кого данная работа может представлять особый интерес.

Текст аннотации должен быть максимально кратким, от 500 до 1000 печатных знаков.

Основные штампы (key-patterns) аннотаций на английском и русском языках:

CONTENTS	**PHRASES**
Introduction:	
Title	*The title of the text is "...".*
Source	*The text is taken from a book "..."*
Author	*The text is written by .../The author of the text is ...*
Main body:	
Main idea	*The main idea of the text under review is.../... is the main idea./The text is about .../The text deals with a problem of ...*
Logical parts	*The text can be divided into ... logical parts./The text contains ... logical parts.*
Description of the first logical part	*The first logical part is about ... . It tells us that ... .*
Description of the second part	*The second logical part deals with ... It describes ... .*

Description of the third logical part	*The third logical part gives information about ... .*
Description of the fourth logical part	*The fourth logical part contains information about ... . It contains figures/ tables/ diagrams.*
Ending:	
Conclusion	*To sum everything up, I can say that ... .*
Attitude to the text	*I like this text, because it is very informative, important and useful for my future professional activity.* *I dislike this text, because it is very boring and unnecessary for my future professional activity.*

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