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**методическиЕ УКАЗАНИЯ**

**для студентов специальностей**

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**TEXT 1**

**KINDS OF COMPUTERS**

***Vocabulary***

to handle - иметь дело, заниматься, обработать

to restrict - ограничить

common – общий, простой, обычный

to solve problem - решать задачу

to count - считать

binary – бинарный, двоичный

decimal - десятичный

tiny - крошечный, миниатюрный

quantity - количество

differential equation - дифференциальное уравнение

Computers are frequently divided into two groups according to the jobs they perform. These groups are general-purpose computers and special-purpose computers. A general-purpose computer can handle many kinds of jobs and is not restricted to any particular user. On the other hand, a special-purpose computer is designed to do one specific job for a particular user.

Computers differ in the way they work as well as in what they can do. On this basis, they can be classified into three general types: (1) digital computers, (2) analog computers, and (3) hybrid computers. Digital computers are by far the most common type.

Digital computers solve problems and do other tasks by counting, comparing, and rearranging digits in the arithmetic/logic unit. All the data, whether in the form of numbers, letters, or symbols, are represented by digits.

Digital computers use the digits of the binary numeration system. Unlike the familiar decimal number system, which uses 10 digits, the binary system uses only two digits: 0 and 1. These binary digits, called pits, can be easily represented by the thousands of tiny electronic circuits of a digital computer. The circuits operate much like an ordinary electric switch. When the switch is off, it corresponds to the binary digit 0. When the switch is on, it corresponds to the digit 1.

Analog computers work directly with a physical quantity, such as weight, voltage, or speed, rather than with digits that represent the quantity. The computers solve problems by measuring the quantity in terms of another quantity. In a problem involving water pressure and water flow, for example, electrical voltage might serve as an analogue (likeness) for the water pressure, and electric current for the water flow. Many familiar devices, including speedometers, thermometers, and thermostats, operate on the same basic principle as analog computers.For example, a thermometer measures temperature in terms of the length of a thin line of liquid in a tube. An analog computer presents output data in a continuous form, often as a position on a scale. In some cases, the data are displayed as electrical signals on an instrument called an oscilloscope.

Hybrid computers combine the features of analog and digital computers. They are as fast as analog computers in solving problems, involving differential equations and as accurate as digital computers.

***Answer the questions.***

1. What are the two groups of computers?

2. What are the three types of computers?

3. What tasks do digital computers do?

4. Digital computers use the digits of the binary numeration system, don’t they?

5. What is the difference between the binary and decimal numeration systems?

6. What is the working principle of an analog computer? How does it work?

7. How do hybrid computers work?

***Retell the text according to the given plan.***

1. Two groups of computers.
2. Three types of computers.
3. Digital computers and tasks they do.
4. Difference between binary and decimal numeration systems.
5. Analog computers and the way they work.
6. Hybrid computers and their characteristics.

**TEXT 2**

**MEMORY**

***Vocabulary***

memory - память

storage - хранение

to store - хранить

formula (*Pl.* formulae) - формула

initial - начальный, исходный, первоначальный

to transmit - передавать, отправлять, посылать, транслировать

computation - вычисление, выкладка, расчет

advantage - преимущество

comparatively - сравнительно

speed - скорость

to be capable of - быть способным к

capacity - емкость, объем, вместимость

cycle time - цикл (обращения к) памяти

failure - отказ

It is interesting to note that memory, one of the basic components of the computer, is often called storage. It stores calculation program, the calculation formulae, initial data, intermediate and final results. Therefore, the functions of the computer memory may be classified in the following way. Firstly, the computer memory, must store the information transmitted from the input and other devices. Secondly, memory should produce the information needed for the computation process to all other devices of the computer.

Generally, memory consists of two main parts called the main, primary or internal, memory andthe secondary or external memory. The advantage of the primary memory is an extremely high speed. The secondary memory has a comparatively low speed, but it is capable of storing far greater amount of information than the main memory. The primary storage takes a direct part in the computational process. The secondary storage provides the information necessary for a single step in the sequence of computation steps.

The most important performance characteristics of a storage unit are speedy capacity and reliability. Its speed is measured in cycle time. Its capacity is measured by the number of machine words or binary digits. Its reliability is measured by the number of failures per unit of time.

***Answer the questions.***

1. What is memory?

2. What is the function of memory?

3. What are the main parts of memory?

4. What are advantages and disadvantages of a storage unit?

5. What are their functions?

6. What are performance characteristics of the main and secondary memory?

7. What units are performance characteristics measured by?

***Retell the text according to the given plan.***

1. The definition of memory.

2. The main functions of memory.

3. Classification of memory.

4. Advantages and disadvantages of memory components.

5. The functions of memory components.

6. Performance characteristics of memory.

7. The units for measuring the performance characteristics of memory.

**TEXT 3**

**PROGRAMMING A DIGITAL COMPUTER**

***Vocabulary***

to involve – включать, содержать

sequence – последовательность, порядок

to refer to – относиться к

to apply to – использовать, применять

to resemble – походить, напоминать

to enable – давать возможность

to suit – соответствовать, подходить

Programming involves the preparation and writing of detailed instructions for a computer. These instructions tell a computer exactly what data to use and what sequence of operations to perform with the data. Without such programs, a computer could not solve problems or give any other desired result.

In most cases, computer scientists and other computer specialists called programmers write the instructions. They refer to programs as software because the instructions have no physical parts. The term hardware is applied to the computer itself, including its electronic circuits and peripheral equipment.

A programmer writes the instructions for a computer in a programming language. Such a language consists of letters, words, and symbols as well as rules for combining those elements. Some programming languages closely resemble the language of mathematics. Others enable programmers to write instructions in simple, everyday expressions, such as "READ", "ADD", and "STOP". Programming languages of this kind are called high-level languages.

The language that a programmer uses depends largely on the job to be done. If a task involves processing business data, the programmer would most likely use COBOL (COmmon Business Oriented Language). However, preparing a computer to solve complicated scientific problems might require the use of ALGOL (ALGOrithmic Language), which is a mathematically oriented programming language.

Some high-level languages can be used for business, technical, or scientific programming. Such languages include FORTRAN (FORmula TRANslation); APL (A Programming Language); and PL/1 (Programming Language One).

Another commonly used programming language is BASIC (Beginner's All-purpose Symbolic Instruction Code). BASIC is well suited for writing relatively simple programs for minicomputers and microcomputers.

Some computer programs may be written in an assembly language. This kind of language is harder to use than a high-level language because it involves symbols as well as words. For example, an assembly language might use the symbols AD for add and S for subtract.

A computer cannot work directly with a program written in a high-level or assembly language. The instructions have to be translated into a machine language composed of binary digits that represent operation codes, memory addresses, and various symbols, such as plus and minus signs. Machine language is also known as low-level language. Special programs called compilers and assemblers translate high-level and assembly languages into machine language.

***Answer the questions.***

1. What does programming involve?

2. What is called software and hardware?

3. What does a programming language consist of?

4. The language that a programmer uses depends largely on the job to be done, doesn’t it?

5. What programming languages are mentioned in the text and what are they used for?

6. Can a computer work directly with a program written in a high-level or assembly language?

7. What are the groups of programming languages?

***Make up a plan and retell the text according to it.***

**TEXT 4**

**ELECTRONICS**

***Vocabulary***

radio tube – электронная лампа, электронный прибор

ordinary – обычный, простой

electric current – электрический ток

to occur – случаться, происходить

layer – слой, покрытие

semiconductor – полупроводник

junction – соединение, стык

solid diode –

familiar – близкий, знакомый

to seek – искать, добиваться

to obtain – получать, приобрести, достичь

Electronics is the science or practice of using electricity in devices similar to transistors and radio tubes so as to get results not possible with ordinary electrical equipment.

Most persons know how electric current flows in motors and transformers; here the electricity always flows in the copper wire or other metal parts. When electricity passes through space as occurs within a tube, such action is called electronic. More recently, when layers of semiconductor metals are joined together so that current flows through the junction in one direction only, as in a solid diode or a transistor, such action is also called electronic. If a device passes its stream of electrons through internal space, or through the junction where certain different metals meet, the device is called electronic.

Without electronics there might be no radio, television, sound pictures or long-distance telephone calls. Most of these familiar equipments serve to carry or give information; so communication early was a main purpose of electronics and still holds interest of many workers and students in this field.

Meanwhile industry seeking faster and more accurate methods of production has adapted electronic equipment to its own needs. Gradually during the past fifty years industrial plants have installed electronic equipment to give better operation of motors along with control of varied operations.

Some people believe that electronic devices can hear, see, feel, smell or even think; this is true only when the sound, image, feeling or thought can be changed into electrical signal, to which the transistor or tube-operated device can then respond. Much of the success of electronics depends on the methods used to obtain an electric signal that can be used to stimulate the electronic device into action. The electronic circuit can be made to detect such a signal, increase its strength and put it to useful work.

***Answer the questions.***

1. What is electronics?

2. What action is called electronic?

3. What was the main purpose of electronics?

4. Where is electronics used?

5. When did industrial plants start to install electronic equipment? Why?

6. Can electronic devices hear, see, feel, smell or think?

7. What does the success of electronics depend of?

***Retell the text according to the given plan.***

1. Definition of electronics.

2. Electronic action and electronic device.

3. Application of electronics.

4. Electronic devices and their capabilities.

**TEXT 5**

**HOW TO SET UP A STEREO SYSTEM**

***Vocabulary***

loudspeaker – репродуктор, акустическая система

to imagine – воображать, представлять себе

lead – провод, подводящий провод

amplifier – усилитель

poor – бедный, плохой

watch out – остерегаться

feedback – обратная связь, отклик

to spoil – портить

stylus jump - перескок воспроизводящей иглы

to mix up – спутать, перепутать

socket – розетка

Have you or your family got a stereo system. If have, are you sure that you are getting the best from it? Expensive equipment can sound very disappointing if it isn’t set up properly. Here are some points to check.

The stereo area is the part of the room in which the listener can hear exactly the right sound. Put the two loudspeakers about two metres apart (more in a very large room, less in a small one). Turn them slightly inwards. Now imagine a line from the centre of each speaker. Where the lines meet is the stereo area and the best place to sit and listen.

There are two important points to remember when you’re deciding where to put the rest of the system. First the lead between the amplifier and the tape or record deck should be as short as possible. A long lead will give poor sound. The leads between the amplifier and the speakers can be as long as you like. Secondly watch out for feedback. This is the sound you hear when vibrations from the music (or even footsteps) affect the record deck. Feedback can spoil the sound of the record or make the stylus jump. The answer is to make sure the record deck is on a wall shelf or a heavy piece of furniture.

If the sound of your stereo is still disappointing, perhaps you’ve mixed up the leads. If you’ve accidentally put a left-hand lead into a right-hand socket, you won’t get a stereo sound. The quickest way to test your stereo system for this, and other problems is to buy a test record, which will have all kinds of sound tests on it.

***Answer the questions.***

1. Why can expensive equipment sound disappointing?

2. What should you do to define a stereo area?

3. What should you remember when you’re deciding where to put the rest of the system?

4. What is a feedback?

5. What is one more reason for a disappointing sound?

6. What is the quickest way to test your stereo system?

***Make up a plan and retell the text according to it.***

**TEXT 6**

**SEVEN RAYS, ONE FAMILY**

***Vocabulary***

ray – луч, излучение

acquaintance – знакомство

to be related to - иметь отношение к, быть связанным с

occurrence – происшествие, случай, явление

visible – видимый

infrared ray - инфракрасное излучение, инфракрасные лучи

X-ray - рентгеновское излучение

frequency – частота

 “Isn’t it a small world.” You have probably heard this exclamation many times. People often say it when they find that acquaintances they had met at different times and places, and whom they never connected with each other, turn out to be related to each other. Scientists often have a similar experience with occurrences in nature. Things or events that at first seem to have nothing to do with each other turn out to be related after all. We shall repeat this experience with seven kinds of rays. We find them in different places, and use them in different ways, but they are close relatives. They are members of one family, the family of electromagnetic waves.

The kind of ray that mankind has known for the longest time is light. It helps us see the objects that surround us, when the objects reflect them into our eyes. Because our eyes can detect light, we call it a visible ray. The other rays are invisible.

We find three types of invisible rays in use in our homes. When we listen to a radio programme, we are using the rays that are called radio waves. When we cook a meal on an electric cooker, we are using infrared rays, sometimes referred to as heat rays. When we sit under a sun-tan lamp, we are using ultraviolet waves. We meet the other three types of rays outside the home. Inside the hospital we shall find X-rays, produced by X-rays machines, and used for taking pictures of the insides of our bodies. At airports everywhere we shall find microwaves used with radar equipment to detect planes in the air, or guide them in to land. Also in hospitals we find gamma rays used as invisible bullets to kill cancer cells.

These seven types of rays resemble each other in that they are all electromagnetic waves. What makes them different from each other is their frequency or their wavelength. The distance that the wave moves during the time it takes for one complete cycle of vibration is called the wavelength of the wave. The frequency is the number of cycles in a second. Notice that radio waves are the longest of the electromagnetic waves and have the lowest frequency.

***Answer the questions.***

1. What are seven types of rays?

2. Which rays are visible and which ones are invisible?

3. Where can we meet different types of rays? Give examples.

4. What do all the types of rays resemble each other in? And what makes them different?

5. What is called the wavelength?

6. What is frequency?

***Make up a plan and retell the text according to it.***

**TEXT 7**

**VACUUM TUBES**

***Vocabulary***

vacuum tube - электронная лампа

thermionic "valves" - катодная лампа, термионная лампа

filament - нить лампы накаливания, катод прямого накала

to charge – заряжать

plate – фотопластинка, пластинка

grid – решётка, сеть высокого напряжения, модулятор

voltage - электрическое напряжение

safe tо say – с уверенностью сказать

solid state electronics - полупроводниковая электроника, электроника твёрдого тела

to withstand – выдержать, выносить, противостоять

The science of electronics now deals almost exclusively with transistors and other solid-state devices. However, vacuum tubes were the principal building blocks, of electronic circuits until approximately 1955. Briefly, a vacuum tube consists of several metal electrodes of various shapes all packaged inside a glass or metal envelope which is highly evacuated. Vacuum tubes are often called thermionic "valves". A red hot metallic electrode (the filament or cathode) emits electrons which are attracted to a positively charged electrode called the plate or anode. The electrons pass through the spaces in a metallic grid electrode on their way to the plate, and the voltage on the grid controls how many electrons reach the plate. A simple thermionic valve is called a diode because it has two electrodes. A triode is a valve with three electrodes, an anode, a cathode and a control grid. A tetrode has four, and a pentode – five electrodes.

Vacuum tubes are still widely used in oscilloscopes, television sets, high power high frequency radio transmitters, and in some special low noise amplifiers. However, every year sees a larger number of applications being transistorized. It is probably safe tо say that this trend will continue in the future, as there is presently a great deal of technological development being put into solid state electronics and rather little put into vacuum tube electronics.

As a general rule, vacuum tubes are inferior to modern solid state devices in many ways. Vacuum tubes are much larger. They require considerably more electric power to operate. However, they can handle high voltages and high powers at high frequencies somewhat more easily than solid state devices. They are also capable of withstanding temporary overloads in voltage or current which would permanently destroy a solid state device and then returning to normal operation.

***Answer the questions.***

1. What does electronics deal with?

2. What does a vacuum tube consist of?

3. Where are vacuum tubes used?

4. Vacuum tubes are inferior to modern solid state devices, aren’t they?

***Make up a plan and retell the text according to it.***

**TEXT 8**

**TRANSISTORS AND SEMICONDUCTOR DEVICES**

***Vocabulary***

semiconductor – полупроводник

crystal set – детекторный приемник

rectifying action – выпрямляющее действие

fine – прекрасный, хороший, тонкий

crystal valve – транзистор

insulator - изоляционный материал, изолятор

point-contact transistor - транзистор с точечными контактами, точечно-контактный транзистор

junction transistor - транзистор с p-n-переходами, контактный плоскостной транзистор

Devices consisting of solid pieces of crystalline material which allowed alternating current to flow more readily оnе direction than the other were known long before the invention of the thermionic valve. The crystal set which became so well known in the early days of radio depended on the rectifying action at the point of contact between the surface of certain crystals and a fine wire. Crystal valves, using silicon crystals, were found to be more efficient for the very high frequency signals reaching radar receivers than any thermionic valves. The action of these devices was not understood, but they were all made from materials which we now classify as semiconductors: substances which let electric current pass through them more easily than insulators do but much less easily than do true conductors. These semiconductor devices were used as rectifiers although by 1924 a scientific worker at the laboratory headed by Bonch-Bruyevich in Nizhni Novgorod Oleg Losev for the first time in the history of electronics had achieved amplification using a semiconductor crystal. Unfortunately, Losev's discovery did not receive due attention.

In 1948 Bardeen and Brattain invented the point-contact transistor and Shockley invented the junction transistor shortly after. The transistor is a semiconductor triode possessing characteristics which are similar in many respects to those of thermionic triodes. At present transistors are widely used in amplifiers, receivers, transmitters, oscillators, TV sets, measuring instruments, pulse circuits, computers, and many other types of radio equipment.

The invention of transistors and solid-state devices led to an acceleration in the growth of electronics. Why were these new devices so important and why are they steadily replacing their older equivalents? A brief review of their advantages compared with thermionic devices will provide the answer to these questions. Transistors are made from parts which do not wear out. Transistors waste very little power. They require no heating to generate their free electrons. This means that equipment made with transistors is more efficient, lighter than comparable valve equipment.

Since no heating is required there is no delay in transistor equipment waiting for things to warm up, as there is with thermionic valves. This is a great advantage with 'entertainment' equipment, such as radio and television receivers, and it may be vital with some kinds of measuring or recording equipment.

Their very small size and weight, combined with low heat dissipation, permits very high density packingof components and, in combination with their reliability, this has made possible the design of the very compact circuits which are essential for such applications as computers, portable measuring instruments, satellite instrumentation, etc.

***Answer the questions.***

1. Crystal valves were found to be more efficient than thermionic valves, weren’t they?

2. Who had achieved amplification using a semiconductor crystal?

3. What is the transistor?

4. Where are transistors used?

5. Why are transistors and solid-state devices replacing their older equivalents?

***Make up a plan and retell the text according to it.***

**TEXT 9**

**FROM RADIO VALVES TO COSMIC COMMUNICATIONS**

***Vocabulary***

printed circuit - гибкая плата, печатная схема

to consume – потреблять, затрачивать

durable – прочный, надёжный

to assemble – собирать, монтировать

crystalline lattice – кристаллическая решетка

property – свойство, качество

germanium plate – германиевая плата/пластина

The reduction of radio instruments to miniature proportions and even smaller – is a major trend in modern radio electronics. The significance of this research has grown especially in connection with space research. It is impossible to equip a rocket for flights to other worlds without light, small and economical electronic apparatuses. The space rockets will carry a large amount of miniature equipment, systems for contact with the Earth, radars, computers for calculating flight trajectories, life-support systems, etc.

Bulky electronic equipment will have no place in the future. It will be unsuitable for automation of production, transport or domestic use.

Semiconductors and printed circuits have helped to reduce the size of apparatus considerably. The semiconducting instruments which have replaced electronic valves are much smaller and lighter, consume less power, are reliable and more durable.

The development of micromodules – tiny ceramic plates with a metallized coating – has opened up big possibilities for making miniature electronic instruments. Semiconductors compressed into this plate are hundreds of times smaller than electronic valves. A radio receiver assembled of micromodules does not weigh more than 50 grammes.

Molecular electronics opens up new possibilities. The crystalline lattice can be changed by tantalum or titanium being added to semiconductors to obtain crystals with the required electrical properties.

At present, a radio-receiving set is assembled of separate, ordinary-size parts. The radio sets based on semiconductors or micromodules are also assembled of separate parts but tens and hundreds of times as small. The germanium or silicon plates will not operate like separate resistors or condensers, but as complete circuits – as generators or amplifiers.

All this might sound fantastic, but a scientist is looking still further ahead. Present research programmes are taking the development of even more miniature parts. We can say that when superminiature elements are developed, it will become possible to place approximately 200 million of these "parts" within one cubic centimetre. The density is approximately that of the human brain.

Cybernetics machines assembled of these units will memorize tremendous volumes of information and will give man invaluable assistance in diverse fields of life.

***Answer the questions.***

1. Why is miniaturization so important?

2. What has helped to reduce the size of apparatus?

3. What has opened up possibilities for making miniature electronic instruments?

4. Molecular electronics opens up new possibilities, doesn’t it?

5. How will germanium or silicon plates operate?

6. What will happen when superminiature elements are developed?

***Make up a plan and retell the text according to it.***

**TEXT 10**

**LASERS AND MASERS**

***Vocabulary***

A laser is a machine for making and concentrating light waves into a very intense beam. The letters LASER stand for Light Amplification by Stimulated Emission of Radiation. The light made by a laser is much more intense than ordinary light. With ordinary light, all the light waves are different lengths. With lasers, all the light waves have the same length, and this increases the intensity.

Atoms are made up of neutrons, electrons and protons. The electrons circle round the protons and neutrons. In a laser, the electrons are "excited" to a high energy level. As the electrons fallback from their "excited" state to their normal state, they give off energy. This energy is given off as light which can be seen. A number of materials have this property including some gases, liquids, solids and semiconductors. Thus a number of different types of lasers have been developed.

Lasers are now used for many scientific, medical and industrial purposes. The thin beam of light gives a lot of heat and it is used to join metal when a very small joint is needed. The beam can also be used as a drill, to make holes in steel, or even in diamonds. Because the beam is so small, it's very important in delicate surgery and is used in eye operations.

Lasers are also used in holography. A hologram is a three-dimensional image, a bit like a photograph. It's different from a photograph because it looks solid. As you walk round a hologram, it changes, as if it were real. Now holography is used for testing engineering ideas. An engineer can use a hologram to build up and check a new building such as a bridge. He can find out all about it before he builds it.

The word MASER is also an acronym – for Microwave Amplification by Stimulated Emission of Radiation. The maser is operated on the same principle as the laser except that the wavelengths generated are much longer and therefore the energy jumps involved are smaller. The excited bodies in a maser are molecules rather than atomic electrons and the beam generated is a coherent beam of microwaves which is not visible to the eye.

Masers have made revolutionary advance possible in a number of different fields. They are up to 1.000 times more sensitive than any other type of amplifiers. Maser amplifiers mounted on radio telescopes can increase even their great range by a factor of 10, allowing us to reach out to the bounds of the known universe. Because of the very constant frequency with which masers can be made to oscillate they can be used as master controls for atomic clocks of unbelievable accuracy: an error not exceeding 1 second in 10.000 years has already been achieved.

The idea of using stimulated emission of radiation for amplification of very short waves came from A.Prokhorov and N.Basov of the Lebedev Institute in Moscow.

***Answer the questions.***

1. What is a laser? What does the word LASER mean?

2. What is the difference between an ordinary light and a laser beam?

3. What are atoms made up of?

4. What is the working principle of a laser?

5. Where are lasers used?

6. What is the meaning of the word MASER?

7. What is the difference between a laser and a maser?

8. Who developed the idea of a maser?

***Make up a plan and retell the text according to it.***

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