МИНИСТЕРСТВО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

САМАРСКИЙ ГОСУДАРСТВЕННЫЙ АЭРОКОСМИЧЕСКИЙ
УНИВЕРСИТЕТ имени академика С.П. КОРОЛЕВА

Учебные задания по теме
«РАДИО И ТЕЛЕВИДЕНИЕ»

САМАРА 2003

Составители: Е.И. Безрукова, О.И. Годяева, Н.Э.Кочурова

ББК

Обучение чтению литературы по специальности «Радио и телевидение» : Учебные задания по англ. яз. / Самарский государственный аэрокосмический университет; Сост.: Е.И. Безрукова, О.И. Годяева, Н.Э. Кочанова. Самара, 2003. 48с.

Целью учебно-методических указаний является подготовка студентов 2 курса радиотехнического факультета к чтению литературы на английском языке по специальности «Радио и телевидение».

При составлении учебных заданий использовались аутентичные тексты из английских и американских источников.

Подготовлены на кафедре иностранных языков.

Печатаются по решению редакционно-издательского совета Самарского государственного аэрокосмического университета имени академика
С.П. Королева.

Рецензент: С.М. Ермишина

Рецензия

на методические указания по теме «Радио и телевидение»

Данные методические указания предназначены для студентов 2 курса радиотехнического факультета.

Методические указания состоят из 6 разделов, направленных на совершенствование навыков перевода научно-технической литературы, устной речи, аннотирования и реферирования. Каждый раздел, посвященный определенному аспекту темы «Радио и телевидение», содержит текст для изучающего чтения, снабженный словарем и тексты для просмотрового чтения. Тексты сопровождаются системой упражнений, способствующих дальнейшему развитию и совершенствованию основных речевых навыков и умений студентов.

Тексты подобраны из оригинальных источников научно-технической литературы радиотехнического профиля.

Организация материала в пособии способствует подготовке студентов к чтению оригинальной литературы по специальности.

Рецензент: С.М. Ермишина

UNIT I

Famous Scientists and their Inventions

Pronunciation drill.

While reading these words pay attention to the stress markings.

● • •	● •	• ●	• ● • •
aerial	triode	within	alternative
average	anode	instead	phenomenon
filament	therefore	prolong	experiment
insulate			
dominance			
measurements			

1. *Read the words and learn them.*

probably - вероятно

bulb - лампочка

oscillation - колебание

thermionic - термоэлектронный

vast - обширный, огромный

incandescent lamp - лампа накаливания

via - через

particularly - особенно

unidirectional - однонаправленный

ray-луч

average - средний

seal - запаивать

serial – антенна

2. *Define to what part of speech the following words belong and translate them.*

building; thermionic; thermionics; invent; inventor; invention; unidirectional; particularly; application; adviser; might; with; never; scientific; alternative; this; various; dominance; dominant.

3. *Read and translate the text using a dictionary.*

Text 1

Ambrose Fleming and his Inventions

You probably would not think of building a radio detector from a light bulb, but that is what he called the "oscillation valve", now better known as the thermionic diode. It was only two years later when Lee de Forest added a third electrode to make the first primitive triode. These two classic inventions led to a fight between the two inventors, but they also led to the now vast, worldwide industry we call electronics.

The story begins with that great American inventor, Thomas Edison. In 1883, he probed inside an incandescent light bulb, first with a wire and then with a metal plate. He found that if this electrode was connected to the positive end of the filament via a galvanometer then a current was detected. If it was connected to the negative end, no current flowed. A little later, using a separate battery in the plate or anode circuit, J.Elster and H.Geitel showed the unidirectional nature of the current flow.

This "Edison effect" was studied by many people over the 20 following years, particularly to examine thermionic emission. Fleming studied it "carefully". Certainly, for 20 years it was a well-known phenomenon before anyone thought of an important application for it.

Fleming's real invention was the use he found for the established Edison effect as a rectifier of high-frequency oscillation.

In 1896 Fleming experimented with methods of focusing cathode rays and three years later he was appointed scientific adviser to the Marconi's Wireless Telegraph Company. In 1904 he had "a happy thought": telephones and meters were too slow to register the positive-negative cycling of a high-frequency radio signal and therefore only indicated the average value, which was zero. Knowing that a light bulb with hot filament and an insulated plate sealed within it would only pass current in one direction, he thought that this might act as a rectifier for the high-frequency current. The next month he wrote to Marconi, "I have been receiving signals on an aerial with nothing but a mirror galvanometer and my device".

Fleming's invention brought him little joy. Marconi's held the patent, and manufactured and used some diodes. But in this early form they played only a small part in the early years of radio.

A couple of years later H.H.Dunwooly, of the De Forest Wireless Co., produced an important **rival** (1) - the crystal detector. This was part of De Forest's effort to **challenge** (2) Marconi's dominance of the radio scene. In 1905 De Forest patented the two-electrode valve with the double-battery Elster-Geitel connection instead of the single battery circuit used by Fleming. Fleming **accused** (3) De Forest of Plagiary. In October 1906, De Forest added the third electrode to make the first triode. The dispute with Fleming was prolonged. However, Flemming never **claimed** (4) to have invented the triode. Though he experimented with *zigzag* wires as alternatives to metal plates for the anode he never used the two together.

Fleming's interests ranged widely over the years. At various times he specialized in transformer tests, standards and measurements, incandescent lamps and photometry, the effects of low temperatures on the electrical resistance of metals and thermionics. He received many honours, including the **Fellowship** (5) of the Royal Society in 1892, medals from scientific and engineering institutions. He was appointed as the first Professor of Physics and Mathematics at the University of Nottingham and later the first Professor of Electrical Engineering at University College, London. He has been described as a born teacher and gave **meticulously** (6) prepared public lectures. But his enduring **fame** (7) rests on turning a light bulb into the first electronic valve.

<u>Notes:</u> 1. rival - соперник, конкурент

2. challenge - бросать вызов

3. accuse - обвинять

4. claim - утверждать

5. fellowship - членство

6. meticulously - тщательно
7. fame – слава

4. *Ask questions to the following answers.*

1. To make the first primitive triode.
2. Yes, they did. They led to the world-wide industry we call electronics.
3. The use he found for the established Edison effect as a rectifier of high-frequency oscillations.
4. No, he didn't. He never used the two together.
5. He specialized in transformer tests, standards and measurements, incandescent lamps, photometry and thermionics.

5. *Find English equivalents for the Russian words and word combinations.*

нить накала; более известный как; через; термоэлектронная эмиссия; хорошо известное явление; высокочастотные колебания; среднее значение; выпрямитель; специализироваться в; воздействия низких температур на; прирожденный преподаватель.

6. *Make up an abstract of the text.*

7. *Read and translate text2 using a dictionary.*

Text 2

Benjamin Franklin

Mention Ben Franklin's name to an electronics engineer and he will probably say "kite experiment". It was, by far, his most famous (and dangerous) moment, but it was not his most important contribution to electrical science. As important, if not more so, were his contributions to the "single-fluid theory" of electricity and his introduction of the words "plus", "minus", "positive", "negative", "charge", and "battery" into electrical terminology.

Outside the field of science, he was a well-known publisher, politician and statesman; his contribution to American politics before, during and after the founding of that nation ensured him a lasting place in history.

Franklin was born in Boston on January 17, 1706. Benjamin was the youngest of 17 children. He died in Philadelphia at the age of 84 on April 17,1790.

Franklin's introduction to the fledgling science of electricity came in the mid-1740s when he saw some demonstrations of electrostatics performed by Adam Spencer.

His evolving theory of electricity bore fruit when he analyzed the Leyden jar capacitor, a glass bottle partly filled with water or metal shot and having the outside clad with metal sheet. He showed that, when the wire connected to the internal conductor was charged positively, then the outside conductor was charged negatively and versa (1747); the next year, he found that the two charges had the same magnitude.

He assumed that "electrical matter" was made up of particles. Particles of ordinary matter attracted one another, according to his theory, whereas particles of electrical matter were mutually repulsive. When electrical matter was introduced into an ordinary body, it immediately diffused through the whole body as if it were "a kind of sponge". When the "sponge" was saturated, the surplus "fire" stayed on the surface and formed an "electrical atmosphere". This atmosphere caused positively charged bodies to repel one another. Though his theory did not explain the repulsion between negatively charged bodies it was very successful and still influences our thought today.

The discovery that lightning is a form of electricity was a huge step forward in experimental science: Priestley called it "the greatest, perhaps, since the time of Sir Isaac Newton". Like Newton's discoveries about light, it showed that experimental science can have some meaning beyond the toys of the laboratory. Further, it proved that electricity was not only generated by man but existed freely in nature. It also showed that man's tinkering with science could lead to useful and practical inventions, in this case the lightning rod. Two hundred years after his death every tall building around us has Benjamin Franklin's invention sitting proudly at its top.

8. *Match a line in* A *with a line in* B.

A	B
1. internal	a. matter
2. experimental	b. invention
3. preliminary	c. science
4. ordinary	d. theory
5. successful	e. terminology
6. useful	f. conductor
7. electrical	g. negotiations

9. *Translate the questions into English and answer them.*

1. Был ли Б. Франклин известен за пределами научной области?
2. Когда и где он родился?
3. Каков его самый важный вклад в науку об электричестве?
4. К какому результату привел его анализ лейденской банки?
5. Почему открытие, что молния - это форма электричества, явилось огромным шагом вперед в экспериментальной науке?

10. *Speak on Ben Franklin's most important contributions to electrical science.*

11. *Read text 3 carefully. There are 5 mistakes in the 2-nd paragraph. Find them and correct them.*

Text3

Alessandro Volta

It is well known that Volta invented the primary battery and in so doing moved electrical science into an age of electrodynamics. What is less well known is that he proposed a fundamental unit of electric tension some years before that invention. It is perfectly appropriate then that the unit for electromotive force (a term he introduced) is named after him.

Volta was already an establishing scientist with a reputation for experimental work when he announced the invention of "Pile", first electric battery. The importance of the invention was instant recognized as being of the first rank and it opened new avenues of enquiry, included electrochemistry and electrodynamics. It quickly led to experimental electric light and industrial electroplating.

In one experiment he brought insulated zinc and copper discs into contact and found that they were charged on separation. By experiment he found that zinc and silver discs best suited his purpose and eventually he arranged pairs of them in a pile. Each pair was separated from neighbouring pairs by a piece of cardboard soaked in water or brine to provide, as he believed, a conducting path between the pairs. Letting all pairs touch one another, he knew, provided only the same effect as a single pair of discs. The finished pile of discs and cardboard multiplied the effects of a single pair many times and he was able to receive a shock from his pile similar to that from a charged Leyden Jar capacitor. The vital differences were that Volta's pile did not need to be immediately recharged and could give a continuous current

News of the invention was announced in a letter to the Royal Society in London. Volta received many honours in his lifetime, including recognition by learned societies in London, Paris and Berlin.

12. *Translate the last 2 paragraphs in writing.*

13. *Translate text 4 in writing.*

Text 4

Walter Schottky

In the parlance of electronics engineers, "Schottky" has passed from being a man's name into being a technical term in very wide use. Walter Schottky's name is associated with thermionic emission, noise, defects in semiconductors and the Schottky diode. It is perhaps best known now in the context of Schottky TTL (Transistor-Transistor Logic), so named because of the modification of standard TTL by the addition of a metal-semiconductor or Schottky diode.

He was born on July 23, 1886 in Zurich, Switzerland, but he spent his life in Germany. He died on March 4,1976 in his 90th year.

Schottky's career spanned the ages of both thermionic valve electronics and solid-state electronics, and he made major contributions to both. He worked in both industrial and university research laboratories, and was known as a modest and selfless character.

Schottky's achievements can be loosely divided into two phases: the first being research into vacuum electronics and the second, starting in 1929, covering semiconductor electronics. His invention of the screen-grid valve or tetrode (which apparently he originally called the protection grid tube) was a major invention in electronics yet in the light of hindsight, it was possibly overshadowed by his prediction of thermal and shot noise, two of the fundamental classes of noise in electronic devices.

The Schottky diode is made from a junction between a metal and a semiconductor instead of a junction between two pieces of semiconductor. Metal-semiconductor junctions are also used for non-rectifying (ohmic) contacts to semiconductor devices.

In thermionic valves, the current emitted from the metal cathode into the vacuum depends, in part, on the metal's work function. Schottky discovered that this work function was lowered from its "normal" value by the presence of image forces and by the electric field at the cathode. This effect became known as the Schottky effect.

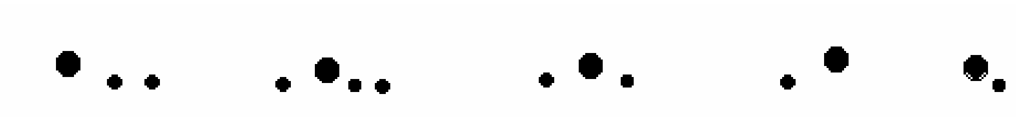
14. *Speak on the famous scientists and their world-known inventions.*

Unit II

Measuring Instruments and Test Equipment

Pronunciation drill.

While reading these words pay attention to the stress markings:



instruments	variety	exception	produce	voltage
measuring	necessitate	transmitter	device	value
miniature	mechanical	resistance	supply	meter
fictional	permissible	reflection	assume	current
minimum		consumption	restore	bearing

1. *Read the words and learn them.*

measuring – измерительный

meter – счетчик, измерительный прибор

to confine - ограничивать

to absorb – поглощать, впитывать

ratio – коэффициент, отношение, пропорция

torque – скручивающее усилие, момент вращения

spindle – ось, вал, шпиндель

accuracy - точность

bearing – подшипник

pointer – указатель, стрелка

to align – выравнивать, спрямлять

consumption – потребление, расход

deflection – отклонение

resistance – сопротивление

voltage drop – перепад давления

to damp – уменьшать амплитуду колебаний, заглушать

to restore – восстанавливать, возмещать

2. *Read and translate the word combinations.*

High-powered transmitters; lower-grade instruments; mechanical torque; anti-parallax mirror; current-measuring device; low voltage drop; voltage-indicating instruments; maximum permissible rated inaccuracies.

3. *Read and translate the text using a dictionary.*

Text 1

Measuring Instruments

(General Considerations, Forces and Accuracies)

Measuring instruments of the “meter” variety used in the radio profession, with the exception of those in high-powered transmitters, are generally confined to the " small normal " and " miniature " sizes. Their scale ares are usually 100-110°, or 80° in the lower-grade.

The primary consideration of an indicating instrument is the low value of electrical power it absorbs from the circuit being metered. This necessitates a high ratio of mechanical torque exercised on the spindle to weight of the moving parts. Frictional resistance of the bearings is reduced to negligible proportions by the use of hardened and highly polished steel and/or sprung jewels. Further accuracy is achieved in some instruments by the use of an " “anti-parallax mirror” mounted behind the indicating pointer. In these cases the pointer and its reflection should be aligned when taking a reading.

To attain a low electrical power consumption, a low value of operating current through the basic movement is normally desirable. Hence, the lower the value of current required to effect FULL-SCALE DEFLECTION (F.S.D.) of the indicating pointer, the more versatile becomes the basic' movement around which the concerned meter is constructed. Incidentally, this results in a more expensive unit. From the viewpoint of minimum power consumption there are two simple rules, these being:

(1) A current-measuring device must be wired in series with the metered circuit, and should thus have low resistance in order that it does not produce appreciable voltage-drops.

(2) A voltage-measuring device must have a high value of resistance, as it is wired in parallel with the circuit or part thereof being metered. The extra current demanded from the metered supply is thus kept to a minimum.

Both considerations involve a low value of electrical power " wasted " in the meter, these_objects being attained in (1) by the low voltage-drop *(E)* across the current-recording instrument and in (2) by the low value of bleeder current (I) in the voltage-indicator.

Four forces operate on the spindle carrying the pointer, these being the actual force, a damping force, mechanical friction and a restoring force.

The actuating force is provided electrically by the metered circuit in the form of ampere-turns, electrostatic attraction and the like. This actuates the pointer, tending to drive it up the scale by imparting angular movement. The damping force or " control torque " operates against the actuating force, compelling the pointer to assume its indicating position of rest without violent oscillation.

The restoring force returns the pointer to the " zero " position on removal of the actual force.

Voltage-indicating instruments and current-indicating instruments are graded according to their maximum permissible rated inaccuracies as shown in Table 1:

Table 1. – Grading of Voltage and Current-Indicating Instruments

	Grading	*Max. Permissible Inaccuracy*
1	Sub -standard	Within 0-2
2	1st grade	Within 1
3	2nd grade	Within 2
4	Ungraded	

4. *Make up questions from separate words and answer them.*
   1. Are, measuring instruments, to, what, confined, generally?
   2. An, primary consideration, is, indicating, instrument, what, the, of ?
   3. Some, further, how, achieved, is, instruments, in, accuracy ?
   4. The, three, forces, on, carrying, do, the, four, operate, spindle, pointer, or ?
   5. Graded, to, voltage-indicating instruments, according, are, and, what, current-indicating instruments ?

5. *Find English equivalents for the Russian words and word combinations.*

Измерительный прибор; миниатюрный; разнообразие; шкала; значение; фрикционное сопротивление; показание; потребление мощности; точка зрения; индикатор напряжения; сильное колебание; в соответствии с; угловое смещение.

6. *Write out sentences with the Absolute Participial Construction and translate them.*

7. *Make up a summary of the text.*

8. *Read and translate text 2 using a dictionary.*

Text 2

Galvanometers

The function of a galvanometer is to detect minute currents, the values of which may be considerably less than I μA. Several entirely different types may be met, these being designed chiefly for laboratory use. Fig.2 shows the general design and construction of the more common type, which operates on the “moving-coil ” (MC) principle. The magnetic field is concentrated in the air-gap between the pole faces of the permanent magnet by the soft iron core (SIC). This also provides a uniform and truly radial magnetic field in which the moving coil operates. The permanent magnet is aged by a special process to ensure constancy of flux throughout its life. The moving coil is wound with fine-gauge, insulated wire on a light, aluminium former, which is pivoted in sprung jewel bearings. The large number of turns provides the necessary ampere-turns for high sensitivity, another contributory factor to this being the small air-gap, which may be of the order of 0-05 in. The energizing current is fed to the moving coil via oppositely wound control springs. The actuating force is provided by motor action between the permanent field and the magnetic field established around the moving coil by the energizing current.

Damping is effected by the decelerating action between the magnetic poles associated with the eddy currents induced into the coil former and those of the permanent field, this increasing with the speed of the pointer deflection.

Errors due to external magnetic fields are eliminated by enclosing the actuating section in a mumetal screen. As the torque varies with the value of actuating current, the pointer deflections are linear, hence the calibrations have equally spaced increments with low-grade galvanometers, full-scale deflection values of 20 μA or so are possible. The centre zero permits double-reading, as the pointer is permitted to swing in either direction according to the direction of the energizing current. This is useful for determining the direction of the current being detected.

9. *Match a line in A with a line in B.*

A:	B:
1. permanent	a. springs
2. moving	b. field
3. magnetic	c. deflection
4. air	d. coil
5. energizing	e. force
6. control	f. magnet
7. actuating	g. gap
8. pointer	h. current

10.*Define the ing-forms of the verbs.*

11.*Put down several questions and retell the text while answering your questions.*

12. *Translate text 3 and 4 in writing.*

Text 3
Transistor Voltmeter

Transistors are essentially current-controlled devices, and hence are not as suitable as valves for use in high-impedance electronic voltmeters. The characteristics of transistors are also very dependent upon temperature.

Transistors, however, are much smaller than valves, need no heater supply and require a much lower " H.T." potential, easily supplied by a dry battery.

Transistor voltmeters normally have a basic full-scale deflection of only a few millivolts, but, by connecting a resistor across the basic input terminals, a number of high-value resistors may be switched in series to provide higher voltage ranges, as in a non-amplifying multi-range voltmeter.

Fig.16b shows a transistor voltmeter in which transistors Tr1 and Tr2 form a balanced voltage amplifier feeding a pair of emitted-follower transistors Tr3, Tr4, which provide additional current amplification. Temperature effects are minimized by the use of balanced pairs of transistors, by the use of silicon rather than germanium transistors and by mounting all transistors close together in a copper block. Such an instrument may have a sensitivity of about 1 megohm/volt.

Text 4
Hot-wire Ammeter

The instrument operates on the expansion principle of a wire under heat treatment. A "heater wire" through which the energizing current is passed has a high coefficient of expansion, a high melting point and a moderately high resistance (in comparison to its length). The heater wire expands due to the heating effect of the actuating current. The heat developed in the heater wire is isolated from the tautening cord by a phosphor-bronze wire. The cord thus maintains a constant length whilst its tension is held steady by the spring. This causes the pulley to rotate and turns the pointer up the scale when the heater wire expands.

The action is inherently sluggish, and damping is not often employed, although some of the better-class instruments are equipped with light metal vanes swinging in a magnetic field. The primary consideration of this arrangement is to avoid rapid pointer movements which would throw excessive strain on the heater wire. Variations in ambient temperature necessitate frequent zero-adjustment. Full-scale deflection current is arranged to take the heater wire almost to its melting point, so even a short overload may fuse it. Hot-wire ammeters are "universal", but errors occur on A.C. if the waveform is not sinusoidal. At higher frequencies (radio frequencies), skin effect introduces a more serious error. Losses are high compared with moving-coil or moving-iron types, and due to the degree of heating required to effect heater expansion full-scale-deflection values below 0-5 amperes are rare.

For radio frequencies, this type of instruments has been virtually superseded by the thermo-junction type.

13. *Make up a summary of text 5.*

Text 5

Frequency-measuring Instruments

A great variety of frequency-measuring devices is available. Generally, these may be segregated into four distinct groups according to their modes of operation.

(1) The heterodyne type of frequency-meter is basically a very low-powered power transmitter convertible by exchange of telephone points into a very low-sensitivity receiver. In both cases the degrees of frequency-calibration and frequency-stability are of a high order. When a transmitter is under frequency check, the instrument becomes a receiver very loosely coupled to it. When a receiver is under frequency check, the telephones are plugged into it and the instrument becomes a transmitter very loosely coupled to it. In both cases heterodyne action takes place, so tuning is adjusted for zero-beat note, the two frequencies concerned then being virtually the same. The required frequency is always read from the meter. This method is the most accurate, errors of within 0-02 per cent being common.

(2) The absorption type of frequency-meter relies for its action on the resultant absorption of radio-frequency power from the metered circuit when the meter is coupled to it. This power is used to actuate a resonance indicator such as a microammeter, a small pea-lamp or a neon tube. These meters are only of use with transmitters or oscillators, and accuracy is of a low order.

(3) A crystal calibrator is basically a heterodyne type of frequency-meter, which does not provide continuously variable tuning but a series of "spot" frequencies, intermediate frequencies being located on the equipment under test by careful interpolation.

(4) The grid-dip oscillator (G.D.O.) functions on a somewhat reverse principle to the absorption-type frequency-meter. It is coupled to a "dead" (non-oscillatory) circuit under check, and the energy abstracted affects the action of the grid-dip oscillator. A resonance indicator shows when this is a maximum.

Frequency meters are also available incorporating digital counters which count the number of cycles in an accurately timed period – usually derived from a 100-kc/s quartz oscillator – and which display the result in figures. Such frequency meters provide extreme simplicity of operation, but are complex in design.

14. *Speak on measuring instruments and test equipment.*

UNIT III

Transistors

1. *Read the words and learn them:*

conductor - проводник

insulator - диэлектрик

possess = have

attach - прикреплять, присоединять, связывать

nucleus — ядро

hence - следовательно

convey - передавать, сообщать

crude - грубый

attempt — попытка

infinitesimal - бесконечно малый

intermediate - промежуточный

semiconductor — полупроводник silicon - кремний

stoichiometric - стехиометрический

pure — чистый

impurity — примесь

excess - избыток, излишек

bond - связь, соединение

behave - вести себя

due to — вследствие, благодаря

intrinsic semiconductor - собственный полупроводник

junction - переход

neighbourhood — соседство, близость

arrangement - схема, устройство, расположение

in consequence - следовательно, вследствие

under development - разрабатываемый

2. *While reading these words pay attention to the stress markings:*

Constitute	materials	nucleus	divide	intermediate
valency	available	concept	convey	manufacture
rapidly	germanium	alloy	attach	resistivity
modulate	specific	neighbour	attempt	independent
consequence	deficiency	increase (n)	exact	disadvantage
	intrinsic	purpose	increase (v)	
	peculiar		excess	
	variety		maintain	
	arrangement		achieve	

3. *Define to what parts of speech these words belong:*

normal, constructional, broadly, categories, electrical, firmly, diffusion, visualize, mathematical, available, conduction, usable, namely, periodic, rapidly, critical, negative, resistivity, impurity, thermal, intrinsic, possible, conductance, complexity, simplified, modification, ability, consequence, characteristics, development.

4. *Translate the text using a dictionary.*

Semi-conductors

Normal constructional materials may be broadly divided into two categories, those which are electrical conductors and those which are electrical insulators. Those in the first category possess a large number of charges (electrons) which are not firmly attached to any particular nucleus, and hence may be thought of as an electron-gas which by diffusion through the body of the conductor serves to convey an electric current. This concept is only a crude attempt to visualize a mechanical model of the conduction process, and for more exact work a mathematical model in which functions replace material particles must be used. In a similar way insulators may be considered as materials in which so few charges are unattached to any specific nucleus that electrical conduction is infinitesimal.

A small number of materials fall into an intermediate category, and are termed semi-conductors. They are so constituted that the number of free charges available for conduction is much smaller than that in a conductor, but much larger than that in an insulator. Only a few of the semi-conducting materials are usable for transistors, namely, the group-four class-three materials such as silicon and germanium, or alloys of their neighbours in the periodic table of elements. In a pure semiconductor the number of free charges increases rapidly with increase of temperature over a critical range, giving it a large negative temperature-coefficient of resistivity. The material used for the manufacture of transistors has a critical amount of impurity which provides a number of free current-carrying charges still small in number compared with those available in a conductor, but large compared with those available due to thermal energy in the pure semi-conductor. Such materials are called impurity semi-conductors.

Two types of impurity may be used to lower the resistivity of a semi-conductor; one type provides an excess of electrons over the critical number required for valency bonding inside the crystal, and because the current-carrying charges are electrons, this class of material is called an n-type semi-conductor; the second type of impurity which may be used causes a deficiency of electrons in the valency bonds of the crystal, and each such deficiency is termed a "positive hole" because it also can provide a conduction current, behaving as though it were a particle with a positive charge due to the interchange of electrons between such deficiencies, and such material is called a p-type semi-conductor. A semiconductor without impurity is called an intrinsic semi-conductor, and, providing the total impurity content is very small, it is possible to so balance the *n*- and p-type impurities that intrinsic-conductance is obtained in the region where such balance is maintained.

An added complexity to the simplified picture above, is responsible for the operation of the transistor. If a current be caused to pass through a junction in an impurity semi-conductor, it can cause a modification to the conductance of the material in the neighbourhood of the flow by modifying the density of the charges available for current-carrying. This effect is responsible also for the ability of the material to "rectify", increasing current in the forward direction causing a decrease in resistivity, and increasing current in the reverse direction causing an increase. In the case of the transistor a small current flowing in the forward direction is used to control the conductivity of the semiconductor, and hence to modulate a second current flowing in the reverse direction between independent electrodes. This effect may be achieved by a number of differing mechanical arrangements, each of which has its own peculiar electrical advantages and disadvantages; in consequence, it seems probable that the variety of transistors available will be as great as that of electronic valves, and a knowledge of their characteristics is essential to choose the optimum type for a particular purpose.

5. *Find Russian equivalents for the English word combinations:*

may be divided into
are not firmly attached
any particular nucleus
may be thought of
fall into a category
the number of charges is much smaller than that in a conductor
charges compared with those available in a conductor
due to thermal energy
required for valency bonding
behaving as though it were a crystal
balance is maintained
is responsible for the operation
by modifying the density
is used to control the conductivity
the types under development

6. *Make up an abstract of the text.*

7. *Additional text No. 1. Fill in the gaps with appropriate words:*

TRANSISTORS AND SEMICONDUCTORS

1. In recent years the transistor - an entirely new type of electron device - has come into its own and bids to replace the bulky electron tubes in many .... Transistors are far smaller than tubes, have no filament and hence need no heating power. They are mechanically rugged, have practically unlimited life, and can do some jobs better than electron tubes, while catching up fast in other respects.

2. In contrast to electron tubes which utilize the flow of free electrons through a vacuum or gas, the transistor relies for its operation on the movement of ... carriers through a solid substance, a semiconductor. Transistors are only one of the family of ....many other semiconductor applications are becoming increasingly popular and new ones are constantly being discovered.

3. It is known that materials are classed as semiconductors if their electrical conductivity is ... between metallic conductors, which have a large number of free electrons available as charge carriers, and non-metallic ..., which have practically no free electrons available to ... current. The two semiconductors frequently used in electronics and transistor manufacture are ... and …. Both elements have the same crystal structure and ... characteristics so that the discussion that follows for germanium is also applied to silicon.

4. It is known that outmost electron shell of an atom contains the loosely held ... electrons, which are easily dislodged to become electric current carriers. Germanium has four valence electrons in outer shell, and for our ..., the atom may be pictured as containing only these electrons and four protons in the ... to keep it electrically neutral.

8. *Additional text No.2.*

In comparison with those of vacuum tube, the advantages of the transistor are so great that it is reasonable to expect that transistors will replace vacuum tubes altogether. The main advantages of the transistor are the following:

1. Absence of filament power loss, transistors have much efficiency.
2. Long life. The life of the average transistor is 10,000 and even more operating hours.
3. Low operating voltages. Small batteries can be used.

4. Small dimensions. Circuits can be miniaturized.

5. Mechanical ruggedness.

One of the principle causes of damages in electronic circuitry is high temperature, the cathode of a vacuum tube being heated to several hundred degrees centigrade above the ambient temperature. Not only does this heat cause break-down of the tubes but it also heats other circuit elements (resistors, electrolitic capacitors and so on) that are very sensitive to this influence. The transistor, on the other hand, does not heat its surroundings to any appreciable extent. Because of its long lifetime and ruggedness, the transistor is very reliable and is indispensable in professional equipment.

However, the transistor has certain drawbacks.

1. A great sensitivity to temperature, either ambient or self-generated.

2. Production problems. It is difficult to reproduce the same electrical qualities in close tolerance for mass production.

3. A low gain at high frequencies.

Intensive research is being done to diminish or remove these drawbacks. Research has already produced the semiconductor materials that are not so sensitive to temperature. It is profitable that new technology (using the diffusion process) will solve the problems of inexpensive mass production, cut-off frequencies, and power dissipation of transistors. Progress is also being made with the internal noise of the transistors, which is now as much as 60 db below that of the earlier types.

Make up a summary of the text using the key words:

advantages, efficiency, dimensions, ruggedness, sensitive, reliable, drawbacks, solve the problem.

UNIT IV

Modulation

Pronunciation drill.

While reading these words pay attention to the stress markings.

●••	•●•	●•●•
anode	emission	modulation
voltage	resistance	complication
modulate	distortion	accidental
detriment	telephony	
	appreciable	
	predominant	

1. *Read the words and learn them.*

band- полоса частот, диапазон

distortion- искажение, деформация

screen- экран

drop – падение, спад, понижение, перепад

in case - в случае

detriment - вред, убыток

winding - обмотка

to furnish - снабжать, поставлять

to insert — вставлять, включать в цепь

choke - катушка, дроссель

drive - управлять, управление

bias - смещение

grid- сетка

adjustment - регулировка, управление

de-coupling - расцепление, нарушение связи
mode-режим работы

2. *Define to what part of speech the following words belong and translate them.*
adjust, adjustment, transmit, transmitter, drop, dropping, dropper, equipment, available, capacitor, carrier, carefully, resultant, amplifier, set, setting, unmodulated, necessitate.

3. *Read and translate the text using a dictionary.*

Text 1.
Modulation

On telephony, amplitude modulation is predominant in all but the **V.H.F.** (1) bands. Anode modulation is most commonly used, since it combines ease of setting-up with relatively low audio distortion at high modulation levels. Where the screens of tetrode valves are supplied via a voltage-dropping resistance from the anode supply, the dropper may simply be fed from the full modulating voltage; a peak voltage of somewhat less than the anode **H.T.** (2) will give 100 per cent modulation in most cases. In the case of some valves the screen dropper may be returned to the unmodulated supply without detriment. With larger valves, where a fixed-voltage screen supply is in use, a separate winding furnishing the appropriate proportion of the full audio voltage is usual. In many cases, however, it is found possible to modulate fully, with low distortion, by inserting a choke in the screen supply and modulating only the anode. In all cases care must be taken to ensure that adequate reserves of cathode emission and of radio-frequency grid drive are available. The cathode bias resistance, if employed, must be decoupled down to the lowest modulation frequencies.

In transmitters of 500 watts and above, anode modulation may be applied to the radio-frequency **driver stage**(3) , and the power amplifier stage run as a Class B radio-frequency amplifier.

In practice, to avoid excessive audio distortion, the power-amplifier grid bias must be set to give an appreciable standing current, in the absence of the carrier, and the degree of radio-frequency drive carefully controlled.

Complications arise with power-amplifier valves -which are driven positive at peaks of modulation, in which case the resultant grid current necessitates a driver stage of the **requisite** (4) good regulation. In the larger equipment stability of operation becomes a major problem under Class B conditions.

Suppressor grid(5) modulation is popular in the smallest equipment, and specially designed valves, such as the Philips PE1/100, enable 90 per cent modulation to be obtained with relatively low distortion by application of an audio voltage to the biased-back suppressor grid. Setting up is simplified, since the valve is run in the Class C mode, without drive adjustments. Since the peak of modulation occurs at zero suppressor volts, there is no **appreciable(6)** suppressor-grid current, and virtually no power is required for modulation.

Fully transistorized modulators are practicable for anode modulation of low-power transmitters, and afford valuable economies where batteries are the source of supply.

Notes:

1. V.H.F - very high frequency – частота метрового диапазона волн
2. H.T. - high tension – высокое напряжение
3. driver stage – задающий каскад, подмодулятор
4. requisite – необходимый, требуемый
5. suppressor grid – пентодная сетка
6. appreciable – значительный

4. *Ask questions to the following answers.*

1. Anode modulation is most commonly used.
2. By inserting a choke in the screen supply.
3. It must be de-coupled down to the lowest modulation frequencies.
4. In the absence of the carrier.

5. It is popular in the smallest equipments.
6. At zero suppressor volts.

5. *Find English equivalents for the Russian words and word combinations.*

амплитудная модуляция, падение напряжения, питание анода, управляющее напряжение на сетке, через, сеточное смещение, напряжение звуковой частоты, регулировка привода, передатчик низкой мощности, фактически, упрощать.

6. *Make an abstract of the text.*

7. *Read and translate text 2 using a dictionary.*

Text 2

LOW- AND HIGH-POWER MODULATION

In a transmitter, at some point in the radio-frequency chain the audio frequency modulating signal must be impressed upon the carrier wave. The amplifying stage which finally introduced the modulating signal into the radio-frequency amplifier is described as the *modulator,* and the radio-frequency stage which is modulated is known as the *modulated amplifier.*

Modulation can be carried out in the final radio-frequency stage or at an earlier stage. If it is introduced at an early point in the chain, the audio-frequency power needed for 100 per cent modulation is low, being in fact, equal to one-half of the radio-frequency power at the anode of the modulated valve. Such a system is termed *low-power modulation.*

The radio-frequency stages following the modulated amplifier are required to amplify modulated radio-frequency signals with negligible distortion, and cannot operate in Class C. Linear Class B amplifiers are necessary and their efficiency is only approximately 35 per cent. This disadvantage largely offsets the advantage of the low audio-frequency power requirements.

When modulation is carried out in the final stage, the audio-frequency power required is considerable, being 60 kW to modulate a radio-frequency amplifier delivering 100 kW. Such a system is described as *high-power* modulation.

It is difficult to generate such audio-frequency power economically, at the same time keeping harmonic distortion low. On the other hand, all the radio-frequency stages in a high-power modulated transmitter, including the modulated amplifier, can operate in Class C, and hence at high efficiency. Thus the disadvantages of the high-power modulator tend to be offset by the economy of the radio-frequency stages. There is therefore very little to choose between low-power and high-power modulation, and both systems have been used in high-power transmitters. The modern tendency seems, however, to be swinging in favour of high-power modulation.

8. *Match a line in A with a line in B.*

A	B
1. modern	a. stage
2. radio	b. wave
3. modulating	c. distortion
4. amplifying	d. frequency
5. modulated	e. amplifier
6. negligible	f. signal
7. carrier	g. Tendency

9. *Translate the questions into English and answer them.*

1. Что называется модулятором?
2. Когда может происходить модуляция?
3. Каковы недостатки модулятора большой мощности?
4. Каковы в настоящее время тенденции в усилении сигналов радио частот?

10. *Speak on low- and high -power modulation..*

11. *Read text 3 carefully.*

Text3

Modulation Systems

Amplitude modulation is usually achieved by arranging for the gain of a radio-frequency amplifier to be proportional to the instantaneous value of the audio-frequency modulating signal.

In most of the circuits used for this purpose the radio-frequency signal is applied to one electrode of a valve and the audio-frequency signal to another; the anode current, being dependent on the voltage of both electrodes, contains modulated radio frequency.

An obvious method is to apply the radio-frequency signal to the control grid of a pentode and the audio frequency signal to the suppressor grid, a circuit with the advantage of requiring negligible audio-frequency power. Although such modulating circuits are used, the gain of the valve is not linearly related to the suppressor-grid voltage, and the distortion introduced precludes the use of such an arrangement in a broadcasting transmitter.

The most linear method of amplitude modulation is to apply the audio-frequency signal to the anode of the modulated amplifier, the radio-frequency signal being applied to the grid. This system, known as anode modulation, is extensively used in broadcasting transmitters in spite of the need for considerable audio-frequency power, the anode circuit of the radio-frequency amplifier representing quite a low impedance.

The good linearity of such a system of modulation is at first sight somewhat surprising, because the static relationship between the anode voltage and anode current of a triode is not, in general, a very good approximation to a straight line. In a modulated amplifier, however, the conditions are dynamic, the grid being biased considerably beyond cut off, but having a large-amplitude radio-frequency signal impressed upon it which gives pulses of anode current. Provided the valve is thus operated under Class C conditions, the relationship between mean anode current and anode potential is very nearly linear and the radio-frequency output of the valve is directly proportional to the anode potential. By swinging the anode potential at an audio frequency, a linearly modulated radio-frequency output can be obtained.

12. *Complete the sentences in accordance with the text.*

1. In most of the circuits the radio-frequency signal is applied to ... (anode; grid; one electrode) of the valve and the audio frequency signal to another.
2. The anode current depends on the ... (voltage on both electrodes; frequency; audio frequency power).
3. Anode current contains modulated ... (audio frequency; radio-frequency; power).
4. The radio-frequency signal is applied to the ... (suppressor grid; circuit; control grid) of a pentode.
5. The gain of the valve is not linearly related to the ... (distortion; broadcasting transmitter; suppressor grid voltage).

13. *Translate the last paragraph in writing.*

14. *Translate text 4 in writing.*

Text 4

Adjustment of Depth of Modulation in Transmitters

When a carrier is 100 per cent modulated by a sinusoidal signal the power radiated increases by 50 per cent. Thus the aerial current increases to V (1-5) = 1-225 of its unmodulated value. This increase of 22-5 per cent is often used as a means of determining when full modulation is reached, and by use of a gain control calibrated in decibels in the modulating-amplifier chain, it is possible to set up any desired modulation depth with reasonable accuracy. For example, suppose it is desired to set up a broadcast transmitter so that, with a certain level of audio-frequency input, the modulation depth is 40 per cent. This input, whatever its value, is 8 db below that which gives 100 per cent modulation. Thus the desired modulation depth is obtained by increasing the gain of the audio-frequency amplifier feeding the modulator until the aerial current meter indicates an increase of 22-5 per cent. The audio-frequency gain is now reduced by precisely 8 db and the required modulation depth is obtained. *This* method is more accurate than attempting to read the increase in aerial current due to 40 per cent modulation. This increase is very small, being only 4 per cent, and is very difficult to read with accuracy.

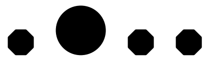
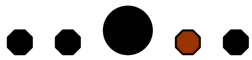
15. *Speak on Modulation.*

UNIT V

Diodes and Rectifiers

Pronunciation drill.

While reading these words pay attention to the stress markings.

		
silicon	germanium	conductivity
substance	conductor	thermionic
capable	divergence	limitation
radar	material	purification
crystal	electron	
rectifier	robust	
eminently	component	
	atomic	
	minute	

1. *Read the words and learn them.*

semi-conductor- полупроводник

intermediate - промежуточный

rectification- выпрямление

tax -определять, устанавливать размер, подвергать испытанию

spacing -расстояние,   промежуток

resurrect - снова использовать

robust - прочный

minute - крошечный

uniform - однородный ,   равномерный

overload - перегрузка

specific gravity - удельный вес
purification -очищение от примесей
notably - а именно
feature -черта, особенность

2. *Define to what part of speech the following words belong and translate them.*

thermionic, conduct, conductor, conductivity, rectify, rectification, rectifier, crystal, crystalline, convert, converter, electric, surface, substance, pure, impurity.

3. *Read and translate the text using a dictionary.*

Text l

CRYSTAL DIODES

A small group of materials of recent development has assumed a particular interest to the radio and television engineer. They are known as **semi-conductors intermediate** in electrical conductivity between conductors and insulators.

Perhaps the most notable **feature** of these materials is that they have non-linear electric-circuit characteristics, i.e., their resistance is much greater when current passes in one direction than in the other. Some of these substances contain electrons in the free state, and under certain conditions are also able to perform the functions so long associated with thermionic valves, viz(l), signal amplification, oscillation, etc.

One of the first practical applications of semi-conductors was that of high-frequency **rectification,** where a metal electrode was fixed by light pressure in contact with the surface of one of several crystalline substances, the pair forming the detector of the early radio receiver. These early crystals were, by modern standards, inefficient and unstable, and were soon displaced by thermionic valves, which were able to function not only as rectifiers but were capable of voltage and power amplification as well.

The development of radar and the increasing use of ultra-high-frequency transmission brought with them problems that **taxed** the resources of valve designers. Even special designs of the thermionic valve had their limitations, since the upper frequency was set by the capacitance between the electrodes and by the transit time of the electrons.

In the crystal type of diode the two electrodes are virtually in contact, so that the electrode **spacing** is practically zero, and the transit time thus becomes very brief. Consequently, with the need in radar practice for a mixer valve operating at about 200 Mc/s, the crystal valve was **resurrected** and was rapidly developed into a **robust** and reliable component of controlled characteristics; later it was used on frequencies of the order of 3,000 Mc/s.

Extensive search was made for a satisfactory semi-conducting contact rectifier, and many of the combinations that had been used in the early days of radio were investigated, along with a number of new materials: carborundum(2), silicon, galena(3), copper pyrites and germanium. Of these the silicon-tungsten(4) combination and germanium have been developed farthest.

Silicon is eminently(5) satisfactory as a frequency-converter, and units have been developed for use up to about 60,000 Mc/s, but it is rather easily damaged by **overload.**

Germanium is chemically a near relative of silicon. Germanium is a silver-white metal of atomic number 32, **specific gravity** 5-4 and atomic weight 72-5. Though still a comparatively rare substance, means have now been developed for the extraction and **purification** of germanium from flue dusts(6)-in gasworks(7) and industrial concerns.

Notes:

1. viz. - то есть, а именно
2. carborundum – карбид кремния
3. galena – галенит
4. tungsten – вольфрам
5. eminently – в высшей степени, чрезвычайно
6. flue dust – колошниковая пыль
7. gasworks – газовый завод

4. *Ask questions to the following answers.*

1. The materials intermediate in electrical conductivity between conductors and insulators are called semi-conductors.
2. The most notable feature of these materials are their non-linear electric-circuit characteristics.
3. They are able to perform signal amplification, oscillation, etc.
4. It was high-frequency rectification.
5. They are: carborundum, silicon, galena,copper pyrites, etc.

5. *Find English equivalents for the Russian words and word combinations.*

кристаллическое вещество, при определенных условиях, практическое применение, свободное состояние, радиоприемник, по современным стандартам, неустойчивый, время прохождения электрона, следовательно, смесительная лампа, полупроводниковый металлический выпрямитель, извлечение и очищение.

6. *Make an abstract of the text.*

7. *Read and translate text 2 using a dictionary.*

Text 2

Silicon Crystal Rectifiers

Prepared as a p-type semi-conductor, the silicon crystal rectifier has been in general use for some years for detection, frequency-changing or mixing circuits handling frequencies above 500 Mc/s. It has uniform H.F. impedance, ability to withstand moderate overload, and low conversion loss and capacitance. These features are attained through small contact area, low forward and relatively high reverse resistance. Its overload capacity is increased by the addition of minute quantities of aluminium and beryllium in addition to the boron impurity which gives the crystal its *p* characteristics.

The boron—silicon crystal is normally prepared by grinding and polishing followed by a heat treatment to produce surface oxidation, which is subsequently removed with acid to leave a pure surface. Crystals of this type are used by connection across a resonant coaxial line, which is tuned and matched to the input signal.

To avoid these somewhat critical adjustments it has been possible to produce these units with fixed dimension and sufficiently close tolerances to match waveguides of given dimensions, and thus permit the use of interchangeable components.

Another type (Form B) is the coaxial unit in which the dimensions of the components are fairly easily controlled, resulting in greater uniformity of electrical characteristics. Being double-ended, this construction enables the unit to function as a dipole and absorb electromagnetic energy of wavelength twice its own length. The shielding of the outer conductor obviates damage from external high-power fields.

8. *Match a line in A with a line in B.*

A	B
1. heat	a. impedance
2. general	b. area
3. uniform	c. quantities
4. moderate	d. resistance
5. pure	e. dimension
6. contact	f. use
7. forward	g. treatment
8. minute	h. overload
9. fixed	i. Surface

9. *Translate the questions into English and answer them.*

1. Где использовались кремниевые, кристаллические выпрямители?
2. Каковы их основные характеристики?

3. Как изготавливаются кристаллы бора - кремния?
4. Что позволяет избежать повреждения от мощных внешних полей?

10. *Speak on Silicon Crystal Rectifiers.*

11. *Read text 3 carefully.*

Text3

PRECAUTIONS

Unless already protected by all-metal construction, these rectifiers are usually supplied enclosed in lead capsules as a protection against damage by strong radio-frequency fields, etc. The capsule should not be removed until the rectifier is put into service.

In the past a disadvantage of the crystal rectifier has been its sensitivity to transient voltage overloads, resulting in its premature deterioration or destruction. Improvements in the treatment of the contact surface have greatly reduced the risk of such damage, but care is still necessary in handling and using the rectifier in the presence of high-voltage transients or in strong radio-frequency fields. It is essential to provide suitable protection, such as a gas switch, where the rectifier is to be used with a common transmitting-receiving aerial arrangement.

In handling, care should be taken not to bring the rectifier into contact with unearthed mains-operated apparatus, that is, it must not provide a discharge path to earth through the body of the user. Broadly speaking, the crystals which are designed for operation at the highest frequencies require the greatest protection against electrical overloads and mechanical shock. In general, crystal rectifiers should be handled with no more and no less care than would be used with a thermionic valve. Wires must not be soldered direct on to the electrodes, but connection must be made by means of the mounting.

12. *Complete the sentences in accordance with the text.*

1. Sensitivity of the crystal rectifier to transient voltage overloads results in its... (premature deterioration, mechanical shock, the presence of high-voltage transients.)

2. These rectifiers are usually supplied in ... (all-metal constructions, lead capsules, strong radio-frequency fields.)

3. A disadvantage of the crystal rectifier is its sensitivity to... (transient voltage overloads, strong radio-frequency fields, suitable protection.)

4. The crystals designed for operation at the highest frequencies require ... (improvements in the treatment, the greatest protection, less care than used with a thermionic valve.)

13. *Translate the last paragraph in writing.*

14. *Enumerate the means of protection of crystal rectifiers mentioned in the text.*

15. *Translate text 4 in writing.*

Text 4

Junction Diodes

In addition to the point-contact types described in this section, various forms of junction diodes have become available recently.

A recent development in germanium junction diodes has been the reduction of the junction area to produce diodes having a capacitance of a few picofarads (compared with some hundreds of picofarads in a conventional junction diode), a high reverse resistance and a hole storage time of a fraction of a microfarad. The forward conductance of such diodes at for example 1 volt may be over 1 amp., compared with the 3-5 mA of a point-contact type. Apart from applications such as waveform clipping, diode modulators, etc., these diodes may also be used as miniature mains rectifiers for transistor supplies, valve-bias supplies, etc.

Another development is the use of a gold wire in place of tungsten, bonded into position by discharging a large pulse of current. These diodes have a forward conductance intermediate between point-contact and small-area junction diodes, but have an even smaller reverse capacitance; a typical figure for forward conductance at 1 volt would be 300 mA.

16. *Speak on Diodes and Rectifiers.*

Unit VI

Capacitors

I. Read the words and learn them:

insulate – изолировать

property – свойство

store – хранить, накапливать

maintain – поддерживать

ratio – соотношение, коэффициент

capacitance – емкость (электролитическая)

by virtue – посредством, благодаря

impart – сообщать, передавать

neighbouring – соседний, смежный

flux – поток

quotient – часть, доля, (мат.) – частное

susceptance – реактивная проводимость

angular frequency – угловая частота

coulomb – кулон

permittivity – диэлектрическая проницаемость

electrical flux density – электрическая индукция

unity – единица

specified – точно определенный, указанный

qoute – делать ссылку, приводить пример

assume – предполагать

prevent –предотвращать, препятствовать

protective envelope – защитная оболочка

wax coating – восковое (парафиновое) покрытие

sealed – герметизированный

impregnation – пропитывание

eminently – в высшей степени, чрезвычайно tuned circuit – резонансный контур

deliberately – намеренно, осознанно

cancel – отменять, ликвидировать

remainder – остаток, остальное

frequency drift – уход частоты

appreciable – ощутимый, значительный

viscous oils – вязкие масла

leak proof – герметичный

cardboard – картон

temperate – умеренный

humid – влажный

rigorously – строго

purity – чистота

etch – травить

gauze – тонкая металлическая сетка

surge voltage – волна перенапряжения

II. While reading these words pay attention to the stress markings:

● . (.)	. ● (.)	. . ● . (.)
insulate	maintain	definition
property	impart	electricity
difference	produce	subdivision
neighbour	surround	calculation
total	divide	permittivity
guotient	increase (v)	centimetre
coulomb	instead	dielectrie
purpose	assume	
substance	prevent	
angular	potential	

frequently	conductor
unity	electrode
specified	susceptance
	capacitance

III. Which of these words are: a) nouns; b) adjectives; c) adverbs; d) participles: property, electric, difference, proportional, various, virtue, surrounding, total, frequency, susceptance, angular, commonly, subdivisions, frequently, substance, insulating, usually, passage.

IV. Translate the following word combinations:

storing an electric charge
in various ways
has to be imparted
surrounding bodies
at a given frequency
divided by
may be defined as
commonly used subdivisions
is frequently used
may be taken as unity
the substance in guestion
instead of air

V. Define the function of the word “that” in the sentence: “The dielectric constant or permittivity...”

VI. Find infinitives and infinitive constructions in the text below. Define their functions. Find Absolute Participial Construction in the last sentence of the passage entitled “The Capacitor”.

VII. Translate the text using a dictionary.

CAPACITORS

Any two conductors which are electrically insulated from one another have the property of storing an electric charge when a potential difference is maintained between them, and the charge is proportional to the potential difference. The ratio of the charge to the potential difference is the capacitance between the conductors. Capacitance may be defined in various ways, and British Standard 205 : 1943 gives the following definitions :

(1) The property of a conducting body by virtue of which a quantity of electricity has to be imparted to it to produce a difference of potential between it and the surrounding bodies.

(2) The ratio of the charge on a conductor to its potential when all neighbouring conductors are at zero potential.

(3) The ratio of the charge of a capacitor, i.e., the total electric flux between its electrodes, to the potential difference between them.

(4) Of a circuit-element at a given frequency — the quotient of the susceptance divided by the angular frequency.

The practical unit of capacitance is the farad (F), which may be defined as the capacitance of a capacitor which stores a charge of one coulomb when the potential between its electrodes is maintained at one volt. Commonly used subdivisions of the farad are the micro-farad (μF) equal to 10^{-6} farad; the micro-micro-farad (μμF) or pico-farad (pF) equal to 10^{-12} farad; and nano-farad equal to 10^{-9} farad. In electrostatic calculations the centimetre is frequently used as the unit of capacitance (1 pF = 0·899 cm.).

Dielectric Constant

The dielectric constant or permittivity of a material is defined as the ratio of the electric flux density produced in the material to that produced in free space (i.e., a vacuum) by the same electric force (see B.S. 205). The dielectric constant of air is 1-006, which for practical purposes may be taken as unity. Thus the dielectric constant of a substance is the ratio in which the capacitance between two electrodes is increased when the space between them is filled with the substance in question instead of air.

The Capacitor

A capacitor is a circuit element in which two conductors or electrodes are arranged to have a specified value of capacitance. The capacitance of a single electrode or conductor is sometimes quoted, and the second electrode is then assumed to be earth. The energy stored in a capacitor is actually stored in the insulating material between the electrodes in the form of an electric stress, and in a capacitor this insulating material is usually called the "dielectric", the term "insulator" being used when the function of the material is only to prevent the passage of current.

Additional text № 1. Translate using a dictionary:

Capacitors

The following brief notes on capacitors refer mainly to changes that have taken place in their use in domestic broadcast receivers.

Ceramic

Ceramic capacitors have improved recently in several ways : (1) there is a greater variety in size, capacitance, working A.C. and D.C. voltages and in temperature coefficient; (2) for a given capacitance, size has been reduced ; (3) temperature stability of high-permittivity types has improved. The most popular form is the tubular construction, but cup and disc types are also used.

The protective envelope may be a wax coating (several thin dips), an outer ceramic tube with sealed ends or a phenolic coating with wax impregnation. Where tolerances of 10 or 20 per cent are acceptable (e.g., oscillator feed capacitors, intermediate-frequency filter capacitors, and radio-frequency coupling capacitors) their compactness and low price make ceramic capacitors eminently suitable. However, they are not generally used for tuned circuits, unless deliberately selected to cancel a positive temperature coefficient of the remainder of the circuit, to reduce frequency drift.

Tubular Foil and Paper Capacitors

Capacitors with solid impregnants have been found generally unsuitable where appreciable A.C. stress (over 100 volts) or over 1,000 volts D.C. are involved. For such uses, petroleum jelly, or better, special viscous oils, are advisable, the latter requiring leak-proof containers. Petroleum jelly does not leak from ordinary containers except at unusually high temperatures.

It is often necessary to ensure that capacitors whose insulation resistance may fall to low values are not, for example, used for coupling from anode to grid. The insulation of the simplest types of wax-coated cardboard-cased capacitors may, for instance, fall as low as 5 MΩ within a year or two, even in a temperate climate.

Electrolytic Capacitors

The chief improvements making for increased reliability are : (1) the almost exclusive use of sealed aluminium containers, and (2) the exclusion of all metal other than aluminium from the construction.

The chief enemy of reliability is corrosion : therefore all foreign matter must be rigorously excluded; and this requires a perfect seal from the atmosphere, a design which specifies materials of high purity, and great care and cleanliness in manufacture.

Great reductions in size have been achieved by replacing plain anode foils by either etched foils or by gauze hot-sprayed with aluminium (sometimes called "fabricated plate" construction).

Voltage.—The manufacturer specifies two voltages, one the maximum working voltage and the other the maximum surge voltage.

The working voltage is equal to the sum of the direct voltage and the peak ripple voltage under conditions which make this sum a maximum. That is with maximum marked mains voltage input (plus 6 per cent for Electricity Supply allowed variation) to that mains tapping which produces the largest direct voltage. The voltage may be measured by means of a peak-reading voltmeter, or a close approximation may be made by adding √*2* times the product of r.m.s. ripple current and reactance to the direct voltage.

The surge voltage is that which occurs every time the set is switched on or under certain accidental conditions such as the open-circuiting of the H.T. line due to a dry joint.

Additional text № 2.

The capacitor is a very simple part, but it can be used in many different kinds of electronic circuits, for many different reasons. A capacitor consists of two metal plates separated by an insulator. When the capacitor is connected to a battery the electrons cannot flow across the open circuit and just accumulate on the plate.

The capacitor is then said to be charged. If the voltage is then removed, the capacitor will hold the charge of electrons inside it. If a resistance such as a lamp is connected across the leads of the capacitor, the current will then flow back out of the capacitor through the lamp, opposite to the way it came in.

The number of electrons the capacitor can hold on one plate depends upon the value of the capacitor. The value of the capacitor depends on the size of the plates, the spacing between the plate and on the insulation between the plates.

The unit that we use to measure this value of capacitance is called the Farad, after Michael Faraday. The capacitor was actually discovered by Pieter Van Musschenbrook in 1715, Leyden, Holland when he used a jar with metal foil to store electrons. It was called the "Leyden Jar".

A farad is an extremely large unit of capacitance. Most of the time, we talk about the value of a capacitor in microfarads. A microfarad is equal to 1 millionth of farad. The largest capacitor on the Ed-Lab[1] trainer is 200 microfarads.

Like all the other units of measure we use in electronics, the microfarad has a symbol: it is MF. The M is the greek letter "mu" and is short for micro, and F means farad.

Sometimes when we use very small amounts of capacitance we use a unit of capacitance called a picofarad. One picofarad is equal to one millionth of a microfarad. Picofarads are shown with the symbol pF. This small value capacitors are used very often in radio circuits.

Notes:

1. Ed-Lab – Educational Laboratory

Make up a summary of the text.

Additional text № 3. Open the brackets and put the words into the correct form.

The capacitor has many (use) properties which can be (use) in the design of electronic circuits. The capacitor only lets current flow when it is being (charge) or discharged. It does not allow a steady current flow, therefore it prevents DC from flowing in a circuit.

AC is (constant) charging the (direct) in which it is (flow). Let's see how this affects a capacitor. As soon as the current starts to flow in one direction, the capacitor begins to change in that direction. Then, when the AC changes direction, the capacitor (charge) and begins charging in the other direction.

If the capacitor is of a high enough value to hold all the electrons that flow through the circuit each time the current flows each way, then the capacitor will have almost no effect on the current and Ac current will always flow.

Even if the capacitor is not big enough to hold all of the electrons, it will hold some of them, so some current will flow. When a capacitor cannot pass all of the current, it opposes the flow of current in the circuit, much the same as a (resist) does in a DC circuit. This (oppose) to current flow or (resist) of the capacitor is called reactance, or capacitive reactance and it is also measured in ohms.

The value of inductance is measured in henries, or "H". A henry is a very large unit of inductance. For most electronic circuits, smaller inductors are used. These are measured in a millihenries. A millihenry is equal to one thousandth of a henry and is written as "mH".

When we have circuits with dc resistances and ac reactances, we call the resultant or the total of resistance and reactance impedance because it reduces or impedes current flow.

VIII. Speak about capacitors.