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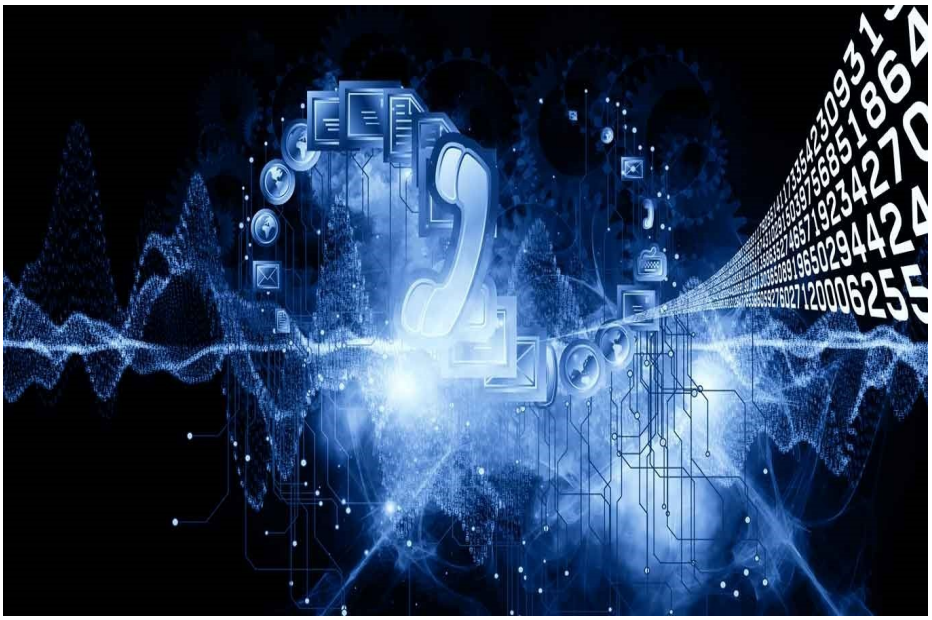
ТЕРМІНОЗНАВСТВО: РАДІОТЕХНІКА І ТЕЛЕКОМУНІКАЦІЇ ЧАСТИНА 2



Міністерство освіти і науки України
Вінницький національний технічний університет

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ЧАСТИНА 2

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Посібник призначений для розвитку навичок та умінь читання й усного мовлення, практичного засвоєння лексичного матеріалу. Рекомендується використання посібника для студентів вищих навчальних закладів, що спеціалізуються в галузі телекомунікацій, радіотехніки, електроніки та фахівців, які прагнуть удосконалити власні навички та вміння перекладу термінологічної лексики.

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CONTENTS

UNIT 1
ELECTRONICS

Text 1
Electronics As a Science

Electronics, field of engineering and applied physics dealing with the design and application of devices, usually electronic circuits, the operation of which depends on the flow of electrons for the generation, transmission, reception, and storage of information. The information can consist of voice or music (audio signals) in a radio receiver, a picture on a television screen, or numbers and other data in a computer.

Electronic circuits provide different functions to process this information, including amplification of weak signals to a usable level; generation of radio waves; extraction of information, such as the recovery of an audio signal from a radio wave (demodulation); control, such as the superimposition of an audio signal onto radio waves (modulation); and logic operations, such as the electronic processes taking place in computers.

At the beginning of the 20th century the introduction of vacuum tubes was the starting point of the rapid growth of modern electronics. With vacuum tubes the manipulation of signals became possible, which could not be done with the early telegraph and telephone circuit or with the early transmitters using high-voltage sparks to create radio waves. For example, with vacuum tubes weak radio and audio signals could be amplified, and audio signals, such as music or voice, could be superimposed on radio waves. The development of a large variety of tubes designed for specialized functions made possible the swift progress of radio communication technology before World War II and the development of early computers during and shortly after the war.

The transistor, invented in 1948, has now almost completely replaced the vacuum tube in most of its applications. Incorporating an arrangement of semiconductor materials and electrical contacts, the transistor provides the same functions as the vacuum tube but at reduced cost, weight, and power consumption and with higher reliability. Subsequent advances in semiconductor technology, in part attributable to the intensity of research associated with the space-exploration effort, led to the development of the integrated circuit. Integrated circuits may contain hundreds of thousands of transistors on a small piece of material and allow the construction of complex electronic circuits, such as those in microcomputers, audio and video equipment, and communications satellites.

Active Vocabulary

amplification – підсилення
application – застосування
applied physics – прикладна фізика

electronic circuits – електронні схеми
generation – створення
high-voltage sparks – розряди високої напруги
integrated circuit – інтегральна схема
power consumption – споживання електроенергії
radio waves – радіохвилі
recovery – відтворення
reliability – надійність
vacuum tube – вакуумна лампа (трубка)

Ex. 1. Answer the following questions

1. What does electronic as a science study?
2. What functions do electronic circuits provide?
3. When were vacuum tubes introduced?
4. How did the development of vacuum tubes contribute to the progress of radio communication technology?
5. When were transistors invented?
6. What were the advantages of transistors over vacuum tubes?

Ex. 2. Translate the following words into Ukrainian

1. integrated circuit 2. weight 3. high reliability 4.power consumption 5. manipulation of signals 6. to be superimposed on radio waves 7. to provide different functions 8. amplification of weak signals 9. applied physics 10. transmission of information 11. communication satellites 12. extraction of information 13. the design of devices 14. radio receiver 15. television screen 16. demodulation 17. vacuum tubes 18. logic operations 19. high-voltage sparks 20. a field of engineering 21. usable level.

Ex. 3. Translate the following words into English

1. прикладна фізика 2. електронні схеми 3. супутники зв'язку 4. дослідження космосу 5. висока надійність 6. збереження інформації 7. аудіосигнал 8. обробка інформації 9. електронні процеси 10. вакуумна трубка 11. обробка сигналу 12. розряди високої напруги 13. підсилення радіосигналів 14. швидкий прогрес 15. напівпровідникові матеріали 16. споживання електроенергії 17. вартість 18. вага 19. інтегральна схема 20. відеообладнання.

Text 2

Electronic Components. Part 1

Electronic circuits consist of interconnections of electronic components. Components are classified into two categories – active or passive. Passive elements never supply more energy than they absorb. Active elements can supply more energy than they absorb. Passive components include resistors, capacitors, and inductors. Components considered active include batteries, generators, vacuum tubes and transistors.

A vacuum tube consists of an air-evacuated glass envelope that contains several metal electrodes. A simple, two-element tube (diode) consists of a cathode and an anode that is connected to the positive terminal of a power supply. The cathode – a small metal tube heated by a filament – frees electrons, which migrate to the anode – a metal cylinder around the cathode (also called the plate). If an alternating voltage is applied to the anode, electrons will only flow to the anode during the positive half-cycle. During the negative cycle of the alternating voltage, the anode repels the electrons, and no current passes through the tube. Diodes connected in such a way that only the positive half-cycles of an alternating current (AC) are permitted to pass are called rectifier tubes. These are used in the conversion of alternating current to direct current (DC). By inserting a grid, consisting of a spiral of metal wire, between the cathode and the anode and applying a negative voltage to the grid, the flow of electrons can be controlled. When the grid is negative, it repels electrons, and only a fraction of the electrons emitted by the cathode can reach the anode. Such a tube, called a triode, can be used as an amplifier. Small variations in voltage at the grid, such as can be produced by a radio or audio signal, will cause large variations in the flow of electrons from the cathode to the anode and, hence, in the circuitry connected to the anode.

Active Vocabulary

absorb energy – споживати електроенергію
alternating voltage – змінна напруга
amplifier – підсилювач
capacitor – конденсатор
cathode – катод
direct current – постійний струм
electronic components – електронні компоненти
grid – решітка
inductor – котушка індуктивності
metal wire – металевий дріт
resistor – резистор
supply – постачання
transistor – транзистор
triode – тріод
two-element tube (diode) – діод

Ex. 1. Answer the following questions

1. What do electronic circuits consist of?
2. What are passive elements?
3. What do active components include?
4. What does vacuum tubes consist of?
5. What are rectifier tubes used for?

Ex. 2. Match the English words in the left column with their Ukrainian equivalents in the right column

semiconductors	надмірна кількість електронів
to pass unimpeded	колектор
field-effect transistor	кремній
repulsion of charges	з домішками
forward bias	напівпровідники
to be doped	проходити без перешкод
silicon	польовий транзистор
an abundance of free electrons	відштовхування зарядів
reverse bias	змінний струм
bipolar transistor	перехід
alternating current	біполярний транзистор
junction	зворотна напруга

Ex. 3. Fill in the missing places in the text "Transistors"

Transistors are made from ….. These are materials, such as ..… or germanium, that are "doped" (have minute amounts of foreign elements added) so that either an ….. or a lack of free electrons exists. In the former case, the semiconductor is called n-type, and in the latter case, p-type. By combining n-type and p-type materials, a ..… can be produced. When this diode is connected to a battery so that the p-type material is positive and the n-type negative, electrons are repelled from the negative battery terminal and pass ….. to the p-region, which lacks electrons. With battery reversed, the electrons arriving in the p-material can pass only with difficulty to the n-material, which is already filled with free electrons, and the current is almost zero.

The ….. transistor was invented in 1948 as a replacement for the triode vacuum tube. It consists of three layers of ..… material, forming two p-n (bipolar) junctions with configurations of p-n-p or n-p-n. One junction is connected to a battery so as to allow current flow (….. bias), and the other junction has a battery connected in the opposite direction (..… bias). If the current in the forward-biased junction is varied by the addition of a signal, the current in the reverse-biased junction of the transistor will vary accordingly. The principle can be used to construct ..… in which a small signal applied to the forward-biased junction causes a large change in current in the reverse-biased junction.

Another type of transistor is the ..… transistor (FET). Such a transistor operates on the principle of ..… or attraction of charges due to a superimposed electric field. Amplification of current is accomplished in a manner similar to the grid control of a ….. tube. Field-effect transistors operate more efficiently than bipolar types, because a large signal can be controlled by a very small amount of energy.

Ex. 4. Translate the following words into Ukrainian

1. a magnetic field 2. a variable capacitor 3. an adjustable sliding contact arm 4. to separate an audio or radio signal from a direct current 5. to accumulate 6. a capacitor 7. an industry material 8. a coil 9. to reach a maximal value 10. to retain the charge 11. a carbon mixture 12. a battery 13.the dimensions of a sample 14. conductivity of the material 15. resistance 16. metal film 17. the attached wires 18. a metal plate 19. a direct current 20. to oppose rapid changes 21. current intensity.

Ex. 5. Translate the following words into English

1. металева пластина 2. змінний резистор 3. еліптичний заряд 4. регулятор 5. котушка індуктивності 6. частота 7. провідність 8. опір 9. проходження струму 10. розмір зрізку 11. виготовлення 12.кремнієвий чіп 13. схеми спеціального призначення 14. розміщення 15. інтегральні схеми 16. напруга батареї 17. провідник 18. акумулювання на кожній пластинці 19. контролювати гучність 20. конденсатор.

Text 3

Electronic Components. Part 2

Most integrated circuits are small pieces, or “chips,” of silicon, perhaps 2 to 4 sq mm (0.08 to 0.15 sq in) long, in which transistors are fabricated. Photolithography enables the designer to create tens of thousands of transistors on a single chip by proper placement of the many n-type and p-type regions. These are interconnected with very small conducting paths during fabrication to produce complex special-purpose circuits. Such integrated circuits are called monolithic because they are fabricated on a single crystal of silicon. Chips require much less space and power and are cheaper to manufacture than an equivalent circuit built by employing individual transistors.

If a battery is connected across a conducting material, a certain amount of current will flow through the material. This current is dependent on the voltage of the battery, on the dimensions of the sample, and on the conductivity of the material itself. Resistors with known resistance are used for current control in electronic circuits. The resistors are made from carbon mixtures, metal films, or resistance wire and have two connecting wires attached. Variable resistors, with an adjustable sliding contact arm, are often used to control volume on radios and television sets.

Capacitors consist of two metal plates that are separated by an insulating material. If a battery is connected to both plates, an electric charge will flow for a short time and accumulate on each plate. If the battery is disconnected, the capacitor retains the charge and the voltage associated with it. Rapidly changing voltages, such as caused by an audio or radio signal, produce larger current flows to and from the plates; the capacitor then functions as a conductor for the changing current. This effect can be used, for example, to separate an audio or radio signal from a direct current in order to connect the output of one amplifier stage to the input of the next amplifier stage.

Inductors consist of a conducting wire wound into the form of a coil. When a current passes through the coil, a magnetic field is set up around it that tends to oppose rapid changes in current intensity. As a capacitor, an inductor can be used to distinguish between rapidly and slowly changing signals. When an inductor is used in conjunction with a capacitor, the voltage in the inductor reaches a maximal value for a specific frequency. This principle is used in a radio receiver, where a specific frequency is selected by a variable capacitor.

Active Vocabulary

accumulate – акумулювати
attached – під'єднаний
conductivity – провідність
conductivity wire – провід
dimension – розмір
fabrication – виготовлення
frequency – частота
insulating material – ізоляційний матеріал
integrated circuits – інтегральні схеми
magnetic field – магнітне поле
photolithography – фотолітографія
resistance – опір
retain the charge – утримувати заряд
sample – зразок
special-purpose circuits – схеми спеціального призначення
variable resistor – змінний резистор

Ex. 1. Answer the following questions

1. What are integrated circuits?
2. Why are integrated circuits called monolithic?
3. What are resistors used for?
4. What do capacitors consist of?
5. What effect can be used to separate an audio or radio signal from a direct current?

Ex. 2. Match the English words in the left column with their Ukrainian equivalents in the right column.

sensing device	термістер
aceleration	датчик
velocity	вимірювання
thermistor	сенсор
transducer	термопара
thermocouple	концентрація хімічних речовин

measurement	прискорення
chemical concentration	визначати світло
to convert	швидкість
to detect light	перетворювати

Ex. 3. Fill in the missing places in the text "Sensing Devices and Transducers"

Measurements of mechanical, thermal, electrical, and chemical quantities are made by devices called sensors and transducers. The sensor is responsive to changes in the quantity to be measured, for example, temperature, position, or ….. concentration. The transducer ….. such measurements into electrical signals, which, usually amplified, can be fed to instruments for the readout, recording, or control of the measured quantities. Sensors and ..… can operate at locations remote from the observer and in environments unsuitable or impractical for humans.

Some devices act as both sensor and transducer. A thermocouple has two junctions of wires of different metals; these generate a small electric voltage that depends on the temperature difference between the two junctions. A ..… is a special resistor, the resistance of which varies with temperature. A variable resistor can convert mechanical movement into an electrical signal. Specially designed capacitors are used to measure distance, and photocells are used to ….. light. Other devices are used to measure ..… , ….. , or fluid flow. In most instances, the electric signal is weak and must be amplified by an ..… circuit.

Text 4

Types Of Circuits

Power Supply Circuits

Most electronic equipment requires DC voltages for its operation. These can be provided by batteries or by internal power supplies that convert alternating current as available at the home electric outlet, into regulated DC voltages. The first element in an internal DC power supply is a transformer, which steps up or steps down the input voltage to a level suitable for the operation of the equipment. A secondary function of the transformer is to provide electrical ground insulation of the device from the power line to reduce potential shock hazards. The transformer is then followed by a rectifier, normally a diode. In the past, vacuum diodes and a wide variety of different materials such as germanium crystals or cadmium sulfide were employed in the low power rectifiers used in electronic equipment. Today silicon rectifiers are used almost exclusively because of their low cost and their high reliability.

Fluctuations and ripples superimposed on the rectified DC voltage (noticeable as a hum in a malfunctioning audio amplifier) can be filtered out by a capacitor; the larger the capacitor, the smaller is the amount of ripple in the voltage. More precise control over voltage levels and ripples can be achieved by a voltage regulator, which also makes the internal voltages independent of

fluctuations that may be encountered at an outlet. A simple, often-used voltage regulator is the zener diode. It consists of a solid-state p-n-junction diode, which acts as an insulator up to a predetermined volt-age; above that voltage it becomes a conductor that bypasses excess voltages. More sophisticated voltage regulators are usually constructed as integrated circuits.

Amplifier Circuits

Electronic amplifiers are used mainly to increase the voltage, current, or power of a signal. A linear amplifier provides signal amplification with little or no distortion, so that the output is proportional to the input. A nonlinear amplifier may produce a considerable change in the waveform of the signal. Linear amplifiers are used for audio and video signals, whereas nonlinear amplifiers find use in oscillator, power electronics, modulators, mixers, logic circuits, and other applications where an amplitude cutoff is desired. Although vacuum tubes played a major role in amplifiers in the past, today either discrete transistor circuits or integrated circuits arc mostly used.

Audio amplifiers, such as are found in radios, television sets, citizens hand (CB) radios, and cassette recorders, are generally operated at frequencies below 20 kilohertz (1 kit/ 1000 cycles/sec). They amplify the electrical signal, which then is converted to sound in a loudspeaker. Operational amplifiers (op-amps), built with integrated circuits and consisting of DC-coupled, multistage, linear amplifiers are popular for audio amplifiers.

Video amplifiers are used mainly for signals with a frequency spectrum range up to 0 megahertz (1 MHz = 1 million cycles/ see). The signal handled by the amplifier becomes the visual information presented on the television screen, with the signal amplitude regulating the brightness of the spot forming the image on the screen. To achieve its function, a video amplifier must operate over a wide band and amplify all frequencies equally and with low distortion.

Radio frequency boots the signal level ol radio or television communication systems. Their frequencies generally range from 100 kHz to 1 GHz(1 billion cycles/see = 1 gigahertz) and can extend well into the microwave frequency range.

Active Vocabulary

amplify frequencies – підсилювати частоти
audio amplifier – підсилювач звуку
be converted into sound – перетворювати в сигнал
discrete transistor circuits – дискретні транзисторні схеми
fluctuation – коливання
form the image on the screen – утворювати зображення на екрані
frequency range – діапазон частоти
ground insulation – заземлення
linear amplifier – лінійний підсилювач
loudspeaker – гучномовець
low distortion – незначне спотворення

oscillator – осцилятор
provide signal amplification – забезпечувати підсилення сигналу
radio frequency amplifier – підсилювати радіочастоти
range from – у діапазоні
rectifier – випрямляч
regulate the brightness of the spot – регулювати яскравість зображення
ripple – фон випрямлювача
signal amplitude – амплітуда сигналу
transformer – трансформатор
video amplifier – відеопідсилювач
waveform of the signal – хвиля сигналу
zener diode – зенеровський, опорний діод

Ex. 1. Answer the following questions

1. What are the factions of transformers?
2. Can a diode be a rectifier?
3. What is a zener diode?
4. What are electronic amplifiers used for?
5. What types of amplifiers do you know?

Ex. 2. Translate the following words into Ukrainian

1. internal power supply 2. voltage regulator 3. zener diode 4. to bypass excess voltage 5. home electric outlet 6. silicon rectifier 7. low cost and high reliability 8. electrical ground insulation 9. transformer 10. to reduce potentional shock hazards 11. cadmium sulfide 12. low-power rectifier 13. fluctuations and ripples 14. to be filtered out by a capacitor 15. malfunctioning audio amplifier 16. a solid state p-n-junction diode 17. germanium crystals 18. DC voltage 19. to convert alternating current 20. to step up or step down the input voltage.

Ex. 3. Fill in the missing words in the text "Oscillators"

Oscillators generally consist of an ….. and some type of feedback: The output signal is fed back to the ..… of the amplifier. The frequency-determining elements may be a tuned inductance-capacitance circuit or a vibrating crystal. Crystal-controlled oscillators offer the highest precision and stability. ..… are used to produce audio and radio signals for a wide variety of purposes. For example, ….. frequency oscillators are used in modem push-button telephones to transmit ..… to the central telephone station for dialing. Audio tones generated by oscillators are also found in alarm clocks, radios, electronic organs, computers, and warning systems. High-..… oscillators are used in communications equipment to provide tuning and signal-detection functions. Radio and stations use precise high-frequency oscillators to produce transmitting frequencies.

Text 5

Recent Development

The development of integrated circuits has revolutionized the fields of communication, information handling, and computing. Integrated circuits reduce the size of devices and lower manufacturing and system costs, while at the same time providing high speed and increased reliability. Digital watches, hand-held computers, and electronic games are systems based on microprocessors. Other developments include the digitalization of audio signals, where the frequency and amplitude of an audio signal are coded digitally by appropriate sampling techniques, that is techniques for measuring the amplitude of the signal at very short intervals. Digitally recorded music shows a fidelity that is not possible using direct-recording methods. Digital playback devices of this nature have already entered the home market. Digital storage could also form the basis of home video systems and may significantly alter library storage systems, because much more information can be stored on a disk for replay on a television screen than can be contained in a book.

Medical electronics has progressed from computerized axial tomography, or the use of CAT or CT scanners, to systems that can discriminate more and more of the organs of the human body. Devices, that can view blood vessels and the respiratory system have been developed as well. Ultrahigh definition television also promises to substitute for many photographic processes, because it eliminates the need for silver.

Today's research to increase the speed and capacity of computers concentrates mainly on the improvement of integrated circuit technology and the development of even faster switching components. Very-large-scale integrated (VLSI) circuits that contain several hundred thousand components on a single chip have been developed. Very-high-speed computers are being developed in which semiconductors may be replaced by superconducting circuits using Josephson junctions and operating at temperatures near absolute zero.

Ex. 1. Answer the following questions

1. Why did the development of integrated circuits revolutionize the fields of communication and computing?
2. What are the advantages of digitalization of audio signals?
3. In what way has medical electronics progressed?
4. What does today's research concentrate on?
5. What are the examples of integrated circuit technology improvement?

Ex. 2. Translate the following words into Ukrainian

1. alter library storage systems 2. blood vessels 3. cat scanner 4. computerized axial tomography 5. computing 6. digital playback devices 7. digitalization of audio signals 8. direct-recording methods 9. fidelity 10. hand-held computers 11. home video system 12. information handling 13. josephson junctions 14. large scale integrated circuits 15. measure the amplitude of the

signal 16. operating at temperatures near absolute zero 17.sampling techniques 18. substitute 19. switching components 20. ultrahigh 21. definition television.

Ex. 3. Fill in the missing words in the text "Switching and Timing Circuits"

Boolean algebra, emitter coupled logic, digital logic gabes, sequential, inputs, true-false, satellite transmission, solid state, microprocessors, logic circuits, metal oxide semiconductor logic, flip-flops, integrated circuits.

Switching and liming circuits, or ….. form the heart of any device where signals must he selected or combined in a controlled manner. Applications of these circuits include telephone switching ….. and digital computer operations.

Digital logic is a rational process for making simple "true" or "false" decisions based on the rules of ….. "True" can be represented by a 1 and "false" by a 0, and in logic circuits the numerals appear as signals of two different voltges. Logic circuits arc used to make specific ..… decisions based on the presence of multiple true-false signals at the inputs. The signals may be generated by mechanical switches or by ..… transducers. Once the input signal has been accepted and conditioned (to remove unwanted electrical signals, or "noise"), it is processed by the digital logic circuits. The various families of digital logic devices, usually ….. perform a variety of logic functions through logic gates, including "OR", "AND", and "NOT", and combinations of these (such as "NOR", which includes both OR and NOT). One widely used logic family is the transistor – transistor logic (TTL). Another family is the complementary ….. (CMOS), which performs similar functions at very low power levels but at slightly lower operating speeds. Several other, less popular families of logic circuits exist, including the currently obsolete resistor-transistor logic (RTL) and ..... (ELC), the latter used for very-high-speed systems.

The elemental blocks in a logic device are called ..…. An AND gate has two or more inputs and a single output. The outputs of an AND gate is true only if all the ..… are true. An OR gate has two or more inputs and a single output. The output of an OR gate is true it any one of the inputs is true and is false if all of the inputs are false. An INVERTER has a single input and a single output terminal and can change a true signal to a false signal, thus performing the NOT function. More complicated logic circuits are built up from elementary gates. They include ..… (binary switches), counters, comparators, adders, and more complex combinations.

To perform a desired overall function, large numbers of logic dements may be connected in complex circuits. In some cases ….. are utilized to perform many of the switching and timing functions of the individual logic elements. The processors arc specifically programmed with individual instructions to perform a given task or tasks. An advantage of microprocessors is that they make possible the performance of different logic functions, depending on the program instructions that are stored. A disadvantage of microprocessors is that

normally they operate in a ..… mode, which may be too slow for some applications. In these cases specifically designed logic circuits are used.

Ex. 4. Translate the following words into Ukrainian

1. switching and timing circuits 2. digital logic 3. to be utilized 4. an inverter 5. multiple true-false signals 6. a transducer 7. a resistor-transistor logic 8. binary switches 9. to operate in a mode 10. emitter coupled logic.

Ex. 5. Prepare reports using Internet or other sources (catalogues, magazines, books, etc.) about the latest news, achievements in the field concerning the topic of the unit

UNIT 2
RADIO

Text 1
Radio

Radio, system of communication employing electromagnetic waves propagated through space. Because of their varying characteristics, radio waves of different lengths are employed for different purposes and are usually identified by their frequency. The shortest waves have the highest frequency, or number of cycles per second; the longest waves have the lowest frequency, or fewest cycles per second. In honor of the German radio pioneer Heinrich Hertz, his name has been give to the cycle per second (hertz, Hz); 1 kilohertz (kHz) is 1000 cycles per sec, 1 megahertz (MHz) is 1 million cycles per sec, and 1 gigahertz (GHz) is 1 billion cycles per sec. Radio waves range a few kilohertz to several gigahertz. Waves of visible light are much shorter. In a vacuum, all electromagnetic waves travel at a uniform speed of about 300,000 km (about 186,000 ml) per second.

Radio waves are used not only in radio broadcasting but in wireless telegraphy, telephone transmission, television, radar, navigational systems, and space communication. In the atmosphere, the physical characteristics of the air cause slight variation in velocity, which are sources of error in such radio-communications systems as radar. Also, storms or electrical disturbances produce anomalous phenomena in the propagation of radio waves.

Because electromagnetic waves in a uniform atmosphere travel in straight lines and because the earth`s surface is approximately spherical, long-distance radio communication is made possible by the reflection of radio waves from the ionosphere. Radio waves shorter than about 10 m (about 33 ft) in wavelength – designated as very high, and superhigh frequencies (VHF, UHF and SHF) – are usually not reflected by the ionosphere; thus, in normal practice, such very short waves are received only within line-of-sight distances. Wavelengths shorter than a few centimeters are absorber by water droplets or clouds; those shorter than 1.5 cm (0.6 in) may be absorbed selectively by the water vapor present in a clear atmosphere.

A typical radio communication system has two main components, a transmitter and a received. The transmitter generates electrical oscillation at a radio frequency called the carrier frequency. Either the amplitude or the frequency itself may be modulated to vary the carrier wave. An amplitude-modulated signal consists of the carrier frequency plus two sidebands resulting from the modulation. Frequency modulation produces more the one pair of sidebands for each modulation frequency. These produce the complex variations that emerge as speech or other in radio broadcasting, and in the alternations of light and darkness in television broadcasting.

Active Vocabulary

alteration – зміна
be absorbed – поглинати
broadcast – транслювати
carrier frequency – носійна частота
cycle per second – період за секунду
cycle – цикл, процес
electrical disturbances – електричні заводи
electromagnetic waves – електромагнітні хвилі
frequency – частота
navigational system – система навігації
propagation – розповсюдження
range – діапазон
sideband – бічна полоса частот
transmitter – передавач
velocity – швидкість
wavelength – довжина хвилі
wireless telegraphy – бездротовий телеграф

Ex. 1. Answer the following questions

1. Why are radio waves employed for different purposes?
2. What waves have the highest and the lowest frequencies?
3. What are the spheres of radio waves usage?
4. What are the main components of a typical radio communication system?
5. What is carrier frequency?

Ex. 2. Give Ukrainian equivalents of the following words

1. television broadcast 2. alternative of light 3. a transmitter 4. to generate electrical oscillations 5. a carrier frequency 6. an amplitude-modulated signal 7.radio broadcasting 8. telephone transmission 9. space communication 10.variations in velocity 11. electrical disturbances 12. propagation of radio waves 13. the water vapor 14. within line-of-sight distances 15. cycle per second 16. to travel at a uniform speed 17. water droplets 18. the reflection of radio waves 19. varying characteristics 20. a sideband.

Ex. 3. Give English equivalents of the following words

1. електромагнітні хвилі 2. генератор коливань 3. частота 4. кількість періодів за секунду 5. електричні заводи 6. розповсюдження хвиль 7. змінні характеристики 8. зміни швидкості 9. відбиття радіохвиль 10. бічна полоса частот 11. передавачі 12. зміна світла 13. бездротовий телеграф 14. діапазон частоти 15. система навігації 16. пара 17. носійна частота 18. електромагнітна радіація 19. створювати значні зміни 20. супутниковий зв’язок 21. довжина хвилі.

Text 2

Transmitter

Essential components of a radio transmitter include an oscillation generator for converting commercial electric power into oscillations of a predetermined radio frequency; amplifiers for increasing the intensity of these oscillations while retaining the desired frequency; and a transducer for converting the information to be transmitted into a varying electrical voltage proportional to each successive instantaneous intensity. For sound transmission a microphone is the transducer; for picture transmission the transducer is a photoelectric device.

Other important components of the radio transmitter are the modulator, which uses these proportionate voltage to control the variations in the oscillation intensity or the instantaneous frequency of the carrier, and the antenna, which radiates a similarly modulated carrier wave. Every antenna has some directional properties, that is, it radiated more energy in some directions than in others, but the antenna can be modified so that the radiation pattern varies from a comparatively narrow beam to a comparatively even distribution in all directions; the latter type of radiation is employed in broadcasting.

The particular method of designing and arranging the various components depends on the effects desired. The principal criteria of a radio in a commercial or military airplane, for example, are light weight and intelligibility; cost is a secondary consideration, and fidelity of reproduction is entirely unimportant. In a commercial broadcasting station, on the other hand, size and weight are of comparatively little importance; cost is of some importance; and fidelity is of the utmost importance, particularly for FM stations; rigid control of frequency is an absolute necessity. In the U.S., for example, a typical commercial station broadcasting on 1000 kHz is assigned a bandwidth of 10 kHz by the Federal Communications Commission, but this width may be used only for modulation; the carrier frequency itself must be kept precisely at 1000 kHz, for a deviation of one-hundredth of 1 percent would cause serious interference with even distant station on the same frequency.

Active Vocabulary

amplifie r – підсилювач
antenna – антена
capacitance – ємність
deviation – відхилення
distribution – розповсюдження
electronic circuits – електронні схеми
inductance – індуктивність
interference – втручання
magnetron – магнетрон
oscillation generator – генератор коливань
radiate – випромінювати
transducer – перетворювач
tuned circuits – узгоджена схема
voltage – напруга

Ex. 1. Answer the following questions

1. What do essential components of a radio transmitter include?
2. What is modulator used for?
3. How can antenna be modified?
4. What do the methods of designing and arranging the various components depend on?
5. What are the principal criteria of a radio?

Ex. 2. Match the English words in the left column with their Ukrainian equivalents in the right column

1. Predetermined radio frequency	a) спричинити втручання
2. Varying electrical voltage	b) миттєва частота
3. To convert electric power into oscillations	c) точність відтворення
4. Transducer	d) попередньо визначена радіочастота
5. Instantaneous frequency	e) перетворювати електроенергію в коливання
6. Fidelity of reproduction	f) змінна електрична напруга
7. To cause interference	g) датчик

Ex. 3. Read the text "Antenna" and make up twelve questions

The antenna of a transmitter need not be close to the transmitter itself. Commercial broadcasting at medium frequencies generally a very large antenna, which is best located at an isolated point far from cities, whereas the broadcasting studio is usually in the heart of the city. FM, television, and other very-high-frequency broadcasts must have very high antennas if appreciably long range is to be achieved, and it may not be convenient to locate such a high antenna near the broadcasting studio. In all such cases, the signals may be transmitted by wires. Ordinary telephone lines are satisfactory for most commercial radio broadcasts; if high fidelity or very high frequencies are required, coaxial cable are used.

Text 3

Oscillators

In a typical commercial broadcasting station the carrier frequency is generated by a carefully controlled quartz-crystal oscillator. The fundamental method of controlling frequencies in most radio work is by means of tank circuits, or tuned circuits, that have specific values of inductance and

capacitance, and that therefore favor the production of alternating currents of a particular frequency and discourage the flow of currents of other frequencies In cases where the frequency must be extremely stable, however, a quartz crystal with a definite natural frequency of electrical oscillation is used to stabilize the oscillations. The oscillations are actually generated at low power by an electron tube and are amplified in a series of power amplifier that act as buffers to prevent interaction of the oscillator with the other components of the transmitter, because such interaction would alter the frequency. The crystal is shaped accurately to the dimensions required to give the desired frequency, desired. In a well-designed circuit, such an oscillator does not vary by more than one-hundredth of 1 percent in frequency. Mounting the crystal in a vacuum at constant temperature and stabilizing the supply voltages may produce a frequency stability approaching one-millionth of 1 percent. Crystal oscillators are most useful in the range termed very low frequency, low frequency, and medium frequency (VLF, LF and MF). When frequencies higher than about 10 MHz must be generated, the master oscillator is designed to generate a medium frequency, which is then double as often as necessary in special electronic circuits. In cases where rigid frequency control is not required, tuned circuits may be used with conventional electron tubes to generate oscillations up to about 1000 MHz, and reflex klystrons are used to generate the higher frequencies up to 30,000 MHz. Magnetrons are substituted for klystrons when even larger amounts of power must be generated.

Active Vocabulary

capacitance – ємність
condenser – конденсатор
discourage – пригнічувати
electronic circuit – електронна схема
inductance – індуктивність
klystron – клістрон
oscillations –коливання
oscillator – генератор коливань
prevent interaction – запобігати взаємодії
tuned circuit – узгоджена схема коливань

Ex. 1. Answer the following questions

1. How is the carrier frequency generated?
2. What are tuned circuits used for?
3. What are their functions?
4. What is used to stabilize the oscillations?
5. What are the advantages of crystal oscillators?

Ex. 2. ***Give Ukrainian equivalents of the following words***

1. turned circuits 2. a frequency stability 3. quartz-crystal oscillator 4.inductance 5. electron tube 6. capacitance 7. to discourage the flow

8. a condenser 9. a magnetron 10. a conventional electron tube 11. to stabilize the oscillations 12. a power amplifier 13. the desire frequency 14. to mount the crystal in a vacuum 15. to be substituted for klystrons 16. to alter the frequency 17. a broadcasting station 18. a buffer 19. dimensions 20. large amounts of power.

Ex. 3. Give English equivalents of the following words

1. узгоджена схема 2. генератор коливання 3. утворювати коливання 4. постійна температура 5. конденсатор 6. стабільність частоти 7. спеціальні електронні схеми 8. бажана частота 9. пригнічувати струм 10. необхідні розміри 11. змінний струм 12. кварцовий генератор коливання 13. у діапазоні низької частоти 14. звичайна електронна трубка 15. індуктивність 16. ємність.

Text 4

Modulation

Modulation of the carrier wave so that it may carry impulses is performed either at low level or high level. In the former case the audio-frequency signal from the microphone, with little or no amplification, is used to modulate the output of the oscillator, and the modulated carrier frequency is then amplified before it is passed to the antenna; in the latter case the radio-frequency oscillations and the audio-frequency signal are independently amplified, and modulation takes place immediately before the oscillations are passed to the antenna. The signal may by impressed on the carrier either by frequency modulation (FM) or amplitude modulation (AM). The simplest form of modulation is keying, interrupting the carrier waves at intervals with a key or switch used to form the dots and dashes in continuous-wave radiotelegraphy.

The carrier wave may also be modulated by varying the amplitude, or strength, of the wave in accordance with the variations of frequency and intensity of a sound signal, such as a musical note. This form of modulation, AM is used in many radiotelephony services including standard radiobroadcasts. AM is also employed for carrier current telephony, in which the modulated carrier is transmitted by wire, and in the transmission of still pictures by wire or radio.

In FM the frequency of the carrier wave is varied within a fixed range at a rate corresponding to the frequency of a sound signal. This form of modulation, perfected in the 1930s, has the advantage of yielding signal relatively free from noise and interference arising from such sources as automobile-ignition systems and thunderstorms, which seriously affect AM signals. As a result, FM broadcasting is done on high-frequency bands (88 to 108 MHz), which are suitable for broad signals but have a limited reception range.

Carrier waves can also be modulated by varying the phase of the carrier in accordance with the amplitude of the signal. Phase modulation, however, has generally been limited to special equipment.

The development of the technique of transmitting continuous waves in short bursts or pulses of extremely high power introduced the possibility of yet another form of modulation, pulse-time modulation, in which the spacing of the pulses is varied in accordance with the signal.

The information carried by a modulated wave is restored to its original form by a reverse process called demodulation or detection. Radio waves broadcast at low and medium frequencies are amplitude modulated. At higher frequencies both AM and FM are in use; in present-day commercial television, for example, the sound may be carried by FM, while the picture is carried by AM. In the superhigh-frequency range (above the ultrahigh-frequency range), in which broader bandwidths are available, the picture also may be carried by FM. Experiments have also been conducted in which sound as well as pictures are transmitted digitally at these high frequencies. Such transmissions may some day replace current analog broadcasting techniques.

Active Vocabulary

amplification – підсилення
amplitude modulation – амплітудна модуляція
detection – виявлення, детектування
frequency modulation – частотна модуляція
intensity of a sound signal – інтенсивність звукового сигналу
keying – кодування
limited reception range – обмежений діапазон отримання сигналу
modulation – модуляція, зміна
phase modulation – фазова модуляція
pulse-time modulation – імпульсна модуляція

Ex. 1. Answer the following questions

1. How is modulation of the carrier wave performed?
2. What is keying?
3. Where is amplitude modulation used?
4. How is the carrier wave varied in frequency modulation?
5. What is detection?

Ex. 2. Give Ukrainian equivalents of the following words

1. demodulation 2. bandwidth 3. to be transmitted digitally 4. current analog broadcasting techniques 5. keying 6. the intensity of a sound signal 7. the transmission of still pictures by wire or radio 8. automobile-ignition systems 9. a limited reception range 10. phase modulation 11. the variations of frequency 12. audio-frequency signal 13. amplification 14. radio-frequency oscillations 15. antenna 16. amplitude modulation 17. to modulate the output to the oscillator 18. to carry impulses 19. modulation of the carrier wave 20. yielding signals.

Ex. 3. Give the definitions of the following terms

amplitude modulation
demodulation.
frequency modulation
high-frequency band
keying
modulation
phase modulation
pulse-time modulation
radiotelegraphy
reception range

Ex. 4. Give English equivalents of the following words

1. детектування 2. діапазон надвисоких частот 3. зворотний процес 4. кодування 5. інтенсивність звукового сигналу 6. переривати носійну хвилю 7. система запалювання автомобіля 8. разова модуляція 9. технологія передачі безперервної хвилі 10. носій 11. імпульсна модуляція 12. антена 13. мікрофон 14. підсилення 15. частотна модуляція 16. аудіочастотний сигнал 17. радіочастотні коливання 18. амплітудна модуляція 19. послуги телефонного зв'язку 20. не зазнавати втручання.

Text 5

Receivers. Part 1

The essential components of a radio receiver are an antenna for receiving the electromagnetic waves and converting them into electrical oscillations; amplifiers for increasing the intensity of these oscillations; detection equipment for demodulating; a speaker for converting the impulses into sound waves audible by the human ear (and in television a picture tube for converting the signal into visible light waves); and, in most radio receivers, oscillators to generate radio-frequency waves that can be "mixed" with the incoming waves.

The incoming signal from the antenna, consisting of a radio-frequency carrier oscillation modulated by an audio-frequency or video-frequency signal containing the impulses, is generally very weak. The sensitivity of some modern radio receivers is so great that if the antenna signal can produce an alternating current involving the motion of only a few hundred electrons, this signal can be detected and amplified to produce an intelligible sound from the speaker. Most radio receives can operate quite well with an input from the antenna of a few millionths of a volt. The dominant consideration in receiver design, however, is that very weak desired signals cannot be made useful by amplifying indiscriminately both the desired signal and undesired radio noise. Thus, the main task of the designer is to assure preferential reception of the desired signal.

Most modern radio receivers are of the superheterodyne type in which an oscillator generates a radio-frequency wave that is mixed with the incoming wave, thereby producing a radio-frequency wave of lower frequency; the latter

is called intermediate frequency. To tune the receiver to different frequencies, the frequency of the oscillations is changed, but the intermediate frequency always remains the same (at 455 kHz for most AM receivers and at 10.7 MHz for most FM receivers). The oscillator is tined by altering the capacity of the capacitor in its tank circuit; the antenna circuit is similarly tuned by a capacitor in its circuit. One or more stages of intermediate-frequency amplification are included in all receivers; in addition, one or more stages of radio-frequency amplification may be included. Auxiliary circuits such as automatic volume control (which operates by rectifying part of the output of one amplification circuit and feeding it back to the control element of the same circuit or of an earlier one) are usually included in the intermediate-frequency stage. The detector, often called the second detector, the mixed being called the first detector, is usually simply a diode acting as a rectifier, and produces an audio-frequency signal. FM waves are demodulated or detected by circuits known as discriminators or radio-detectors than translate that translate the varying frequencies into varying amplitudes.

Amplifiers

Radio-frequency and intermediate-frequency amplifiers are voltage amplification. In addition, the last stage before the speaker must be a stage of power amplification. A high-fidelity receiver contains both the tuner and amplifier circuits of a radio. Alternatively, a high-fidelity radio may consist of a separate audio amplifier and a separate radio tuner.

The principal characteristics of a good radio receiver are high sensitivity, selectivity, fidelity, and low noise. Sensitivity is primarily achieved by having numerous stages of amplification and high amplification factors, but high amplification is useless unless reasonable fidelity and low noise can be obtained. The most sensitive receivers have one stage of tuned radio-frequency amplification. Selectivity is the ability of the receiver to obtain signals from one station and reject signals from another station operating on a nearby frequency. Excessive selectivity is not desirable, because a bandwidth of many kilohertz is necessary in order to receive the high-frequency components of the audio-frequency signals. A good broadcast-band received tuned to one station has a zero response to a station 20 kHz away. The selectivity depends principally on the circuits in the intermediate-frequency stage.

Active Vocabulary

discrimination – розрізнення, розпізнавання
intermediate frequency – проміжна частота
mixer – перетворювач частоти
noise – рівень шуму
radio tuner – радіоприймальний пристрій
selectivity – вибірність
signal discrimination – розпізнавання сигналу
arequency discrimination – виявлення частоти

Ex. 1. Answer the following questions

1. What are the essential components of a radio receiver?
2. What is intermediate frequency?
3. What stages of intermediate – frequency amplification are included in receivers?
4. What are the functions of radio-detectors?
5. Name the principal characteristics of a good radio receiver.

Ex. 2. Give Ukrainian equivalents of the following words

1. intermediate frequency 2. oscillator3. sensitivity 4. fidelity5. power amplification 6. rectifier 7. radio-detector 8. high-fidelity receiver 9. intelligible sound 10. radio 11. antenna 12. detection equipment 13. to convert the impulses 14. signal amplitude 15. audio-frequency voltage amplification 16. to reject the signals 17. automatic volume control 18. selectivity.

Ex. 3. Give English equivalents of the following words

1. підсилювач 2. перетворювач частот 3. проміжна частота 4. зрозумілий звук 5. чутливість 6. вибірність 7. низький рівень шуму 8. автоматичний контроль звуку 9. підсилення потужності 10. частота 11. розпізнавати сигнал 12. радіочастотна хвиля 13. розрізнення 14. радіоприймальний пристрій 15. основні характеристики 16. діапазон 17. виявлення частоти.

Text 6

Receivers. Part 2

High-Fidelity Systems

Fidelity is the equality of response of the receiver to various audio-frequency signals modulated on the carrier. Extremely high fidelity, which means a flat frequency response (equal amplification of all audio frequencies) over the entire audible range from about 20 Hz to 20 kHz, is extremely difficult to obtain. A high-fidelity system is no stronger than its weakest link, and the links include not only all the circuits in the receiver, but also the speaker, the acoustic properties of the room in which the speaker is located, and the transmitter to which the receiver is tuned. Most AM radio stations do not reproduce faithfully sounds below 100 Hz or above 5 kHz. FM stations generally have a frequency range of 50 Hz to 15 kHz, the upper limit being set by Federal Communications Commission regulations.

Distortion

A form of amplitude distortion is often introduced to a radio transmission by increasing the relative intensity of the higher audio frequencies. At the receiver, a corresponding amount of high-frequency attenuation is applied. The net effect of these two forms of distortion is a net reduction in high-frequency background noise or static at the receiver. Many receivers are also equipped with user-adjustable tone controls so that the amplification of high and low frequencies may be adjusted to suit the listener's taste. Another source of distortion is cross modulation, the transfer of signals from one circuit to another through improper

shielding. Harmonic distortion caused by nonlinear transfer of signals through amplification stages can often be significantly reduced by the use of negative-feedback circuitry that tends to cancel most of the distortion generated in such amplification stages.

Noise

Noise is a serious problem in all radio receivers. Several different types of noise, each characterized by a particular type of sound and by a particular cause, have been given names. Among these are hum, a steady low-frequency note (about two octaves below middle C) commonly produced by the frequency of the alternating-current power supply (usually 60 Hz) becoming impressed onto the signal because of improper filtering or shielding; hiss, a steady high-frequency note; and whistle, a pure high-frequency note produced by unintentional audio-frequency oscillation, or by beats. These noises can be eliminated by proper design and construction. Certain types of noise, however, cannot be eliminated. The most important of these in ordinary AM low-frequency and medium-frequency sets is static, caused by electrical disturbances in the atmosphere. Static may be due to the operation of nearby electrical equipment (such as automobile and airplane engines), but is most often caused by lightning. Radio waves produced by such atmospheric disturbances can travel thousands of kilometers with comparatively little attenuation, and inasmuch as a thunderstorm is almost always occurring somewhere within a few thousand kilometers of any radio receiver, static is almost always present. Static affects FM receivers to a much smaller degree, because the amplitude of the intermediate waves is limited in special circuits before discrimination, and this limiting removes effects of static, which influences the signal only by superimposing a random amplitude modulation on the wave.

Another basic source of noise is thermal agitation of electrons. In any conductor at a temperature higher than absolute zero, electrons are moving about in a random manner. Because any motion of electrons constitutes an electric current, this thermal motion gives rise to noise when amplification is carried too far. Such noise can be avoided if the signal received from the antenna is considerably stronger than the current caused by thermal agitation; in any case, such noise can be minimized by suitable design. A theoretically perfect receiver at ordinary temperatures can receive speech intelligibly when the signal power in the antenna is only 4 x 10 W (40 attowatts); in ordinary radio receivers, however, considerably greater signal strength is required.

Power Supply

A radio has no moving parts except the speaker cone, which vibrates within a range of a few thousandths of a centimeter, and so the only power required to operate the radio is electrical power to force electrons through the various circuits. When radios first came into general use in the 1920s, most were operated by batteries. Although batteries are used widely in portable sets today, a power supply from a power line has advantages, because it permits the designer more freedom in selecting circuit components. If the alternating-current (AC) power supply is 120 V, this current can be led directly to the primary coil

of a transformer, and power with the desired voltage can be drawn off as desired from the secondary coils. This secondary current must be rectified and filtered before it can be used because transistors require direct current (DC) for proper operation. Electron tubes require DC for plate current; filaments may be heated either by DC or AC, but in the latter case hum may be created. Transistorized radios do not require as high an operating DC voltage as did tube radios of the past, but power supplies are still needed to convert the AC voltage distributed by utility companies to DC, and to step up or step down the voltage to the required value, using transformers. Airplane and automobile radio sets that operate on 12 to 24 volts DC often contain circuits that convert the available DC voltage to AC, after which the voltage is stepped up or down to the required voltage level and again converted to DC by a rectifier. Airplane and automobile radio sets that operate on 6 to 24 volts DC always contain some such device for raising the voltage. The advent of transistors, integrated circuits, and other solid-state electronic devices, which are much smaller in size and require very little power, has today greatly reduced the use of vacuum tubes in radio, television, and other types of communications equipment and devices.

Active Vocabulary

attenuation – затухання сигналу
cross modulation – перехресна модуляція
filament – нитка розжарювання
hiss – шипіння
hum – гудіння
negative-feedback circuitry – коло з від'ємним зворотним зв'язком
plate supply – анодне живлення
power supply – джерело живлення
shielding – екранування
thermal agitation – теплове збудження
to impress – прикладати напругу
whistle – свист

Ex. 1. Answer the following questions

1. What is fidelity?
2. Name the forms of distortion.
3. What is the function of user-adjustable tone controls?
4. How can harmonic distortion be reduced?
5. Name different types of noise and their sources.

Ex. 2. Give English equivalents of the following words

1. коло з від'ємним зворотним зв'язком 2. перехресна модуляція 3. високочастотне затухання сигналу 4. неправильне екранування 5. системи високої якості 6. аудіочастотні сигнали 7. рівномірне підсилення 8. налаштовувати приймач 9. амплітудне спотворення 10. відносна інтенсивність 11. значно зменшувати 12. передавати сигнали

від однієї схеми до іншої 13. статичність приймача 14. суцільний діапазон 15. акустичні властивості 16. найслабша ланка 17. створювати звуки нижче 100 hz або вище 5 khz 18. стадії підсилення 19. зниження фонового звуку 20. верхня межа.

Ex. 3. Match the English words in the left column with their Ukrainian equivalents in the right column

1. Fidelity	a) схема зворотного зв'язку
2. Cross modulation	b) носій
3. Distortion	c) якість
4. Attenuation	d) екранування
5. Carrier	e) висока якість
6. High fidelity	f) затухання сигналу
7. Shielding	g) перехресна модуляція
8. Feedback circuitry	h) спотворення
9. To adjust	i) налагодження

Text 7

History Of Radio. Part 1

Although many discoveries in the field of electricity were necessary to the development of radio, the history of radio really began in 1873, with the publication by the British physicist James Clerk Maxwell of his theory of electromagnetic waves.

Late 19th Century

Maxwell's theory applied primarily to light waves. About 15 years later the German physicist Heinrich Hertz actually generated such waves electrically. He supplied an electric charge to a capacitor, and then short-circuited the capacitor through a spark gap. In the resulting electric discharge the current surged past the neutral point, building up an opposite charge on the capacitor, and then continued to surge back and forth, creating an oscillating electric discharge in the form of a spark. Some of the energy of this oscillation was radiated from the spark gap in the form of electromagnetic waves. Hertz measured several of the properties of these so-called Hertzian waves, including their wavelength and velocity.

The concept of using electromagnetic waves for the transmission of messages from one point to another was not new; the heliograph, for example, successfully transmitted messages via a beam of light rays, which could be modulated by means of a shutter to carry signals in the form of the dots and dashes of the Morse code. Radio has many advantages over light for this purpose, but these advantages were not immediately apparent. Radio waves, for example, can travel enormous distances; but microwaves (which Hertz used) cannot. Radio waves can be enormously attenuated and still be received, amplified, and detected; but good amplifiers were not available until the

development of electron tubes. Although considerable progress was made in radiotelegraphy (for example, transatlantic communication was established in 1901), radiotelephony might never have become practical without the development of electronics. Historically, developments in radio and in electronics have been interdependent.

To detect the presence of electromagnetic radiation Hertz used a loop of wire somewhat similar to a wire antenna. At about the same time the Anglo-American inventor David Edward Hughes discovered that a loose contact between a steel point and a carbon block would not conduct current, but that if electromagnetic waves were passed through the junction point, it conducted well. In 1879 Hughes demonstrated the reception of radio signals from a spark transmitter located some hundreds of meters away. In these experiments he conducted a current from a voltaic cell through a glass tube filled loosely with zinc and silver filings, which cohered when radio waves impinged on it. The principle was used by the British physicist Sir Oliver Joseph Lodge, in a device called the coherer, to detect the presence of radio waves. The coherer, after becoming conductive, could again be made resistant by tapping it, causing the metal particles to separate. Although far more sensitive than a wire loop in the absence of an amplifier, the coherer gave only a single response to sufficiently strong radio waves of varying intensities, and could thus be used for telegraphy but not for telephony.

The Italian electrical engineer and inventor Guglielmo Marconi is generally credited with being the inventor of radio. Starting in 1895 he developed an improved coherer and connected it to a rudimentary form of antenna, with its lower end grounded. He also developed improved spark oscillators, connected to crude antennas. The transmitter was modulated with an ordinary telegraph key. The coherer at the receiver actuated a telegraphic instrument through a relay, which functioned as a crude amplifier. In 1896 he transmitted signals for a distance exceeding 1.6 km (more than 1 ml), and applied for his first British patent. In 1897 he transmitted signals from shore to a ship at sea 29 km (18 ml) away. In 1899 he established commercial communication between England and France that operated in all types of weather; early in 1901 he sent signals 322 km (200 ml), and later in the same year succeeded in sending a single letter across the Atlantic Ocean. In 1902 messages were regularly sent across the Atlantic, and by 1905 many ships were using radio for communications with shore stations. For his pioneer work in the field of wireless telegraphy, Marconi shared the 1909 Nobel Prize in physics with the German physicist Karl Ferdinand Braun.

During this time various technical improvements were being made. Tank circuits, containing inductance and capacitance, were used for tuning. Antennas were improved, and their directional properties were discovered and used. Transformers were used to increase the voltage sent to the antenna. Other detectors were developed to supplement the coherer with its clumsy tapper; among these were a magnetic detector that depended on the ability of radio waves to demagnetize steel wires; a bolometer that measured the rise in

temperature of a fine wire when radio waves are passed through the wire; and the so-called Fleming valve, the forerunner of the thermionic tube, or vacuum tube.

Ex. 1. Answer the following questions

1. When did the history of radio begin?
2. How did Heinrich Hertz generate light waves electrically?
3. What experiment did D.E. Hughes demonstrate in 1879?
4. What is Guglielmo Marconi famous for?
5. Name other technical improvements of that time?

Ex. 2. Give Ukrainian equivalents of the following words

1. hertzian waves 2. heliograph 3. electromagnetic radiation 4. a loop of wire 5. a spark transmitter 6. a crude amplifier 7. tank circuit 8. capacitance 9. a magnetic detector 10. a wireless telegraphy 11. function point 12. a spark gap 13. velocity 14. a coherer 15. a relay 16. a shutter 17. transmission of message 18. to attenuate the waves.

Ex. 3. Give English equivalents of the following words

1. електромагнітні хвилі 2. застосовувати теорію 3. електричний розряд 4. довжина хвилі 5. швидкість 6. визначати електромагнітні випромінювання 7. передавати сигнал 8. підсилювач 9. вакуумна трубка 10. провідність 11. налагодження 12. вимірювати температуру 13. взаємозалежний 14. провідник.

Text 8

History Of Radio. Part 2

The 20th Century

The modern vacuum tube traces its development to the discovery made by the American inventor Thomas Alva Edison that a current will flow between the hot filament of an incandescent lamp and another electrode placed in the same lamp, and that this current will flow in only one direction. The Fleming valve was not essentially different from Edison's tube. It was developed by the British physicist and electrical engineer Sir John Ambrose Fleming in 1904 and was the first of the diodes, or two-element tubes, used in radios. This tube was then used as a detector, rectifier, and limiter. A revolutionary advance, which made possible the science of electronics, occurred in 1906 when the American inventor Lee De Forest mounted a third element, the grid, between the filament and cathode of a vacuum tube. De Forest's tube, which he called an audion but which is now called a triode (three-element tube), was first used only as a detector, but its potentialities as an amplifier and oscillator were soon developed, and by 1915 wireless telephony had developed to such a point that communication was established between Virginia and Hawaii and between Virginia and Paris.

The rectifying properties of crystals were discovered in 1912 by the American electrical engineer and inventor Greenleaf Whittier Pickard, who pointed out that crystals can be used as detectors. This discovery gave rise to the so-called crystal sets popular about 1920. In 1912 the American electrical engineer Edwin Howard Armstrong discovered the regenerative circuit, by which part of the output of a tube is fed back to the same tube. This and certain other discoveries by Armstrong form the basis of many circuits in modern radio sets.

In 1902 the American electrical engineer Arthur Edwin Kennelly and the British physicist and electrician Oliver Heaviside, independently and almost simultaneously, announced the probable existence of a layer of ionized gas high in the atmosphere that affects the propagation of radio waves. This layer, formerly called the Heaviside or Kennelly-Heaviside layer, is one of several layers in the ionosphere. Although the ionosphere is transparent to the shortest radio wavelengths, it bends or reflects the longer waves. Because of this reflection, radio waves can be propagated far beyond the horizon. Propagation of radio waves in the ionosphere is strongly affected by time of day, season, and sunspot activity. Slight variations in the nature and altitude of the ionosphere, which can occur rapidly, can affect the quality of long-distance reception. The ionosphere is also responsible for skip, the reception at a considerable distance of a signal that cannot be received at a closer point. This phenomenon occurs when the ground ray has been absorbed by the intervening ground and the ionospherically propagated ray is not reflected at an angle sufficiently steep to be received at short distances from the antenna.

Short-wave Radio

Although parts of the various radio bands – short-wave, long-wave, medium-wave, very-high frequency, and ultrahigh frequency – are allocated for a variety of purposes, the term short-wave radio generally refers to radiobroadcasts in the high-frequency range (3 to 30 MHz) beamed for long distances, especially in international communication. Microwave communication via satellite, however, provides signals with superior reliability and freedom from error.

Amateur, or "ham," radio is also commonly thought of as short-wave, although amateur operators have been allotted frequencies in the medium-wave band, the very-high-frequency band, and the ultrahigh-frequency band as well as the short-wave band. Certain of these frequencies have restrictions designed to make them available to maximum numbers of users.

During the rapid development of radio in 1921, amateur operators executed such spectacular feats as the first transatlantic radio contact. They have also provided valuable voluntary assistance during emergencies when normal communications are disrupted. Amateur radio organizations have launched a number of satellites piggyback with regular launches by the United States, the former Soviet Union, and the European Space Agency. These satellites are usually called Oscar, for Orbiting Satellites Carrying Amateur Radio. The first,

Oscar 1, orbited in 1961, was also the first nongovernmental satellite; the fourth, in 1965, provided the first direct-satellite communications between the U.S. and the Soviet Union. More than 1.5 million people worldwide were licensed amateur radio operators in the early 1980s.

Radio Today

Immense developments in radio communication technology after World War II helped make possible space exploration, most dramatically in the Apollo moon-landing missions (1969-72). Sophisticated transmitting and receiving equipment was part of the compact, very-high-frequency, communication system on board the command modules and the lunar modules. The system performed voice and ranging functions simultaneously, calculating the distance between the two vehicles by measuring the time lapse between the transmission of tones and the reception of the returns. The voice signals of the astronauts were also transmitted simultaneously around the world by a communications network.

Ex. 1. Answer the following questions

1. What was a revolutionary advance that made possible the science of electronics?
2. Who discovered the rectifying properties of crystals?
3. What Armstrong discoveries formed the basis of many circuits in modern radio sets?
4. In what way does a layer of ionized gas high in the atmosphere affect the propagation of radio waves?
5. What does the term short-wave radio generally refer to?

Ex. 2. Give Ukrainian equivalents of the following words

1. a layer of ionized gas 2.propagation of radio waves 3. incandescent lamp 4. a limiter 5. rectifying properties 6. regenerative circuit. 7.frequency band 8. a grid 9. reliability 10. freedom from error 11. radio communication technology 12. command modules 13. lunar modules 14. transmission of tones 15. reception of the returns 16. ultrahigh-frequency band 17. short-wave radio 18. a hot filament 19. potentialities 20. to mount.

Ex. 3. Give English equivalents of the following words

1. проходження струму 2. революційний винахід 3.незначні зміни 4. достатньо стійкий 5. швидкий розвиток 6.у діапазоні надвисоких частот 7. запускати супутники 8. радіотрансляція 9. переривати процес комунікації 10. дослідження космосу 11. удосконалювати обладнання 12. місячні модулі 13. транспортні засоби 14. звуковий сигнал.

Ex. 4. Prepare reports using Internet or other sources (catalogues, magazines, books, etc.) about the latest news, achievements in the field concerning the topic of the unit

UNIT 3
TELEVISION

Text 1
Television

Television is a system of sending and receiving pictures and sound by means of electronic signals transmitted through wires and optical fibers or by electromagnetic radiation. These signals are usually broadcast from a central source, a television station, to reception devices such as television sets in homes or relay stations such as those used by cable television service providers. Television is the most widespread form of communication in the world, though most people will never meet the leader of a country, travel to the moon or participate in a war, they can observe these experiences through the images on their television.

Television has a variety of applications in society, business and science. The most common use of television is as a source of information and entertainment for viewers in their homes. Security personnel also use televisions to monitor buildings, manufacturing plants and numerous public facilities. Public utility employees use television to monitor the condition of an underground sewer line, using a camera attached to a robot arm or remote-control vehicle. Doctors can probe the interior of a human body with a microscopic television camera without having to conduct major surgery on the patient. Educators use television to reach students throughout the world.

People in the United States have the most television sets per person of any country, with 835 sets per 1,000 people as of 2000. Canadians possessed 710 sets per 1,000 people during the same year. Japan, Germany, Denmark and Finland follow North America in the number of sets per person.

Active Vocabulary

broadcast – віщати
monitor – слідкувати, контролювати
optical fibers – оптичне волокно
possess – оволодіти
probe – прощупувати, зондувати
relay stations – ретрансляційна станція
remote-control – дистанційне керування
sewer line – стічна труба, колектор
transmit – повідомляти
utility – комунальні підприємства

Ex. 1. Answer the following questions

1. What is television?
2. How are electronic signals broadcast?
3. What is the most widespread form of communication in the world?

4. What experiences can most people observe through the images on their television?

5. Does television have a variety of applications in society or science?

6. What is the most common use of television?

7. Why do security personnel use televisions?

8. In what way do public utility employees monitor the condition of an underground sewer line?

9. What is the advantage of using a microscopic television camera for doctors?

10. Where do people have the most television sets per person?

Ex. 2. Give English equivalents of the following words

джерело інформації
дріт
електронний сигнал
застосування
звук
приймаючий прилад
спілкування
транслювати
широко розповсюджений

Ex. 3. Read and memorize the following words and word-combinations

1. *A TV set* is an electronic device that receives television signals and displays them on a screen.

2. *A television station* is a station for the production and transmission of television broadcasts.

3. *Cable television* is a system of delivering television programming to paying subscribers via radio frequency (RF) signals transmitted through coaxial cables or light pulses through fiber-optic cables.

4. *A signal* is an electrical or electromagnetic current that is used for carrying data from one device or network to another.

Text 2

How Television Works

A television program is created by focusing a television camera on a scene. The camera changes light from the scene into an electric signal, called the video signal, which varies depending on the strength, or brightness, of light received from each part of the scene. In color television, the camera produces an electric signal that varies depending on the strength of each color of light.

Three or four cameras are typically used to produce a television program. The video signals from the cameras are processed in a control room, then combined with video signals from other cameras and sources, such as videotape recorders, to provide the variety of images and special effects seen during a television program.

Audio signals from microphones placed in or near the scene also flow to the control room, where they are amplified and combined. Except in the case of live broadcasts (such as news and sports programs) the video and audio signals are recorded on tape and edited, assembled with the use of computers into the final program, and broadcast later. In a typical television station the signals from live and recorded features, including commercials, are put together in a master control room to provide the station's continuous broadcast schedule. Throughout the broadcast day, computers start and stop videotape machines and other program sources, and switch the various audio and visual signals. The signals are then sent to the transmitter.

The transmitter amplifies the video and audio signals, and uses the electronic signals to modulate, or vary, carrier waves (oscillating electric currents that carry information). The carrier waves are combined (diplexed), then sent to the transmitting antenna, usually placed on the tallest available structure in a given broadcast area. In the antenna, the oscillations of the carrier waves generate electromagnetic waves of energy that radiate horizontally throughout the atmosphere. The waves excite weak electric currents in all television-receiving antennas within range. These currents have the characteristics of the original picture and sound currents. The currents flow from the antenna attached to the television into the television receiver, where they are electronically separated into audio and video signals. These signals are amplified and sent to the picture tube and the speakers, where they produce the picture and sound portions of the program.

Active Vocabulary

amplify – розширюватися, збільшуватися, підсилюватися
antenna [æn'tenə] – антена
assemble – монтувати
diplexed – одночасно передаватись в одному напрямку
excite – викликати
oscillating electric current – коливний електричний струм, потік
radiate – розходитися променями
range – діапазон
scene – епізод, кадр
speaker – динамік
transmitter – трансмітер, передавач
vary – змінювати

Ex. 1. Answer the following questions

1. What is a television program created by?
2. What does the video signal depend on?
3. How many cameras are typically used to produce a television program?
4. Why are the video signals from the cameras combined with video signals?
5. What happens to audio signals from microphones?

6. What is put together to provide the station's continuous broadcast schedule?

7. What is the function of computers throughout the broadcast day?

8. What signals does the transmitter amplify?

9. What wwaves are sent to the transmitting antenna?

10. Where is the transmitting antenna usually placed?

Ex. 2. Give English equivalents of the following words

відеомагнітофон
графік трансляцій
електричний потік
звуковий потік
кімната управління
мікрофон
первісне зображення

Ex. 3. Read the following sentences and write T for true statements and F for false statements

1. The camera changes light from the scene into a loud signal.

2. In color television an electric signal depends on the strength of each color of light.

3. The video signals from the cameras are processed in a control pool.

4. In the case of news and sports programs the video and audio signals are not recorded on tape.

5. The transmitter uses the electronic signals to modulate carrier waves.

6. In the antenna, the oscillations of the carrier waves do not generate electromagnetic waves of energy.

7. The electromagnetic waves of energy radiate horizontally throughout the atmosphere.

8. The waves excite strong electric currents in all television-receiving antennas.

9. The currents flow from the television receiver to the antenna.

10. Audio and video signals are sent to the native speakers.

Text 3

Television Camera

The television camera is the first tool used to produce a television program. Most cameras have three basic elements: an optical system for capturing an image, a pickup device for translating the image into electronic signals, and an encoder for encoding signals so they may be transmitted.

Optical System

The optical system of a television camera includes a fixed lens that is used to focus the scene onto the front of the pickup device. Color cameras also have a system of prisms and mirrors that separate incoming light from a scene into the

three primary colors: red, green and blue. Each beam of light is then directed to its own pickup device. Almost any color can be reproduced by combining these colors in the appropriate proportions. Most inexpensive consumer video cameras use a filter that breaks light from an image into the three primary colors.

Pickup Device

The pickup device takes light from a scene and translates it into electronic signals. The first pickup devices used in cameras were camera tubes. The first camera tube used in television was the iconoscope. Invented in the 1920s, it needed a great deal of light to produce a signal, so it was impractical to use in a low-light setting, such as an outdoor evening scene. The image-orthicon tube and the vidicon tube were invented in the 1940s and were a vast improvement on the iconoscope. They needed only about as much light to record a scene as human eyes need to see. Instead of camera tubes, most modern cameras now use light-sensitive integrated circuits (tiny, electronic devices) called charge-coupled devices (CCDs).

When recording television images, the pickup device replaces the function of film used in making movies. In a camera tube pickup device, the front of the tube contains a layer of photosensitive material called a target. In the image-orthicon tube, the target material is photoemissive – that is, it emits electrons when it is struck by light. In the vidicon camera tube, the target material is photoconductive – that is, it conducts electricity when it is struck by light. In both cases, the lens of a camera focuses light from a scene onto the front of the camera tube, and this light causes changes in the target material. The light image is transformed into an electronic image, which can then be read from the back of the target by a beam of electrons (tiny, negatively charged particles).

The beam of electrons is produced by an electron gun at the back of the camera tube. The beam is controlled by a system of electromagnets that make the beam systematically scan the target material. Whenever the electron beam hits the bright parts of the electronic image on the target material, the tube emits a high voltage, and when the beam hits a dark part of the image, the tube emits a low voltage. This varying voltage is the electronic television signal.

A charge-coupled device (CCD) can be much smaller than a camera tube and is much more durable. As a result, cameras with CCDs are more compact and portable than those using a camera tube. The image they create is less vulnerable to distortion and is therefore clearer. In a CCD, the light from a scene strikes an array of photodiodes arranged on a silicon chip. Photodiodes are devices that conduct electricity when they are struck by light; they send this electricity to tiny capacitors. The capacitors store the electrical charge, with the amount of charge stored depending on the strength of the light that struck the photodiode. The CCD converts the incoming light from the scene into an electrical signal by releasing the charges from the photodiodes in an order that follows the scanning pattern that the receiver will follow in re-creating the image.

Encoder

In color television, the signals from the three camera tubes or charge-coupled devices are first amplified, then sent to the encoder before leaving the camera. The encoder combines the three signals into a single electronic signal that contains the brightness information of the colors (luminance). It then adds another signal that contains the code used to combine the colors (color burst), and the synchronization information used to direct the television receiver to follow the same scanning pattern as the camera. The color television receiver uses the color burst part of the signal to separate the three colors again.

Active Vocabulary

array – сітка, ряд
beam – промінь
capacitor – конденсатор
charge-coupled device (CCD) – прилад із зарядовим зв'язком
color burst – сигнал кольорової синхронізації
distortion – спотворення
durable – довговічний, надійний
electron gun – електронний прожектор
encoder – кодувальний пристрій
iconoscope [ai'kɔnəskəʊp] – іконоскоп
image orthicon – суперортикон (трубка з накопиченням заряду та переносом зображення з фотокатода на двусторонню мішень)
integrated circuit – інтегральна схема
invented – винайдений
light-sensitive – світлочутливий
luminance [lu:mɪn(ə)ns] – сигнал яскравості
pickup device – уловлювальний пристрій
release the charge – відпускати, відштовхувати заряд
scanning pattern – діаграма сканування
setting – місце, оточення
silicon chip – кремнієва мікросхема
target – анод
target material – анодний, опромінюванний матеріал
vidicon – відікон, фотопровідна передавальна трубка
vulnerable [`vəln(ə)rəbəl] – уразливий

Ex. 1. Answer the following questions

1. What is is the first tool for producing a television program?
2. What basic elements do most cameras have?
3. What is a fixed lens used for?
4. What primary colors is incoming light separated into?
5. What filter do most inexpensive consumer video cameras use?
6. When was the first camera tube used in television invented?

7. Why were the image-orthicon tube and the vidicon tube better than the iconoscope?

8. When does the pickup device replace the function of film used in making movies?

9. What does it mean that in the vidicon camera tube the target material is photoconductive?

10. How is the beam of electrons produced?

11. In what case does the camera tube emit a high voltage?

12. Why does the color television receiver use the color burst part of the signal?

Ex. 2. Complete the beginning of the sentences

1. The optical system of a television camera includes	a) directed to its own pickup device.
2. Color cameras have	b) were invented in the 1940s.
3. Each beam of light is	c) conduct electricity when they are struck by light.
4. The pickup device takes light from a scene	d) called charge-coupled devices.
5. The image-orthicon tube and the vidicon tube	e) a system of prisms and mirrors.
6. Modern cameras now use light-sensitive integrated circuits	f) a system of electromagnets.
7. In the image-orthicon tube, the tar-get material is photoemissive – that is,	g) and translates it into electronic signals.
8. The beam of electrons is controlled by	h) into an electrical signal.
9. A charge-coupled device can be much smaller than	i) a fixed lens.
10. Photodiodes are devices that	j) it emits electrons when it is struck by light.
11. The encoder combines the three signals	k) a camera tube.
12. A charge-coupled device converts the incoming light from the scene	l) into a single electronic signal.

Ex. 3. Give English equivalents of the following words

висока напруга
вхідне світло
дзеркало
інструмент
кодувальний пристрій
негативно заряджені частинки
непрактичний

відповідне співвідношення
споживча відеокамера
стаціонарна лінза
удосконалення

Text 4

Scanning

Television cameras and television receivers use a procedure called scanning to record visual images and re-create them on a television screen. The television camera records an image, such as a scene in a television show, by breaking it up into a series of lines and scanning over each line with the beam or beams of electrons contained in the camera tube. The pattern is created in a CCD camera by the array of photodiodes. One scan of an image produces one static picture, like a single frame in a film. The camera must scan a scene many times per second to record a continuous image. In the television receiver, another electron beam – or set of electron beams, in the case of color television – uses the signals recorded by the camera to reproduce the original image on the receiver's screen. Just like the beam or beams in the camera, the electron beam in the receiver must scan the screen many times per second to reproduce a continuous image.

In order for television to work, television images must be scanned and recorded in the same manner as television receivers reproduce them. In the United States, broadcasters and television manufacturers have agreed on a standard of breaking images down into 525 horizontal lines, and scanning images 30 times per second. In Europe, most of Asia, and Australia, images are broken down into 625 lines, and they are scanned 25 times per second. Telecine equipment (from the words television and cinema) is used to convert film and slide images to television signals. The images from film projectors or slides are directed by a system of mirrors toward the telecine camera, which records the images as video signals.

The scanning method that is most commonly used today is called interlaced scanning. It produces a clear picture that does not fade. When an image is scanned line by line from top to bottom, the top of the image on the screen will begin to fade by the time the electron beam reaches the bottom of the screen. With interlaced scanning, odd-numbered lines are scanned first, and the remaining even-numbered lines are scanned next. A full image is still produced 30 times a second, but the electron beam travels from the top of the screen to the bottom of the screen twice for every time a full image is produced.

Active Vocabulary

break down – розділяти
continuous image – неперервне зображення
even-numbered lines – парні ряди
fade – зникати, стиратися
frame – кадр

interlaced scanning – скачкове розгортання
odd-numbered lines – непарні ряди
static picture – заставка
telecine [`tɛlɪ`sɪni] – телекінопроекційний

Ex. 1. Answer the following questions

1. What procedure do television receivers use?
2. In what way does the television camera record an image?
3. How often must the camera scan a scene to record a continuous image?
4. Must the electron beam in the receiver scan the screen four times per second?
5. What have broadcasters and TV manufacturers agreed on in the USA?
6. Why is telecine equipment used for?
7. What is the function of the telecine camera?
8. What picture does the interlaced scanning produce?
9. In what case will the top of the image on the screen begin to fade?
10. When are odd-numbered lines scanned first?
11. How often is a full image produced?
12. What image is produced 30 times a second?

Ex. 2. Give English equivalents of the following words

відтворювати зображення
візуальне відображення
екран
зверху донизу
обладнання
приймальний екран
промінь електронів
фільмопроектор

Ex. 3. Make up questions to which the italicized words are the answers

1. The pattern is created *in a charge-coupled device camera* by the array of photodiodes.
2. One scan of an image produces *one* static picture.
3. An electron beam uses the signals recorded by the camera *to reproduce the original image on the receiver's screen.*
4. *Television images* must be scanned in the same manner as television receivers reproduce them.
5. *In Australia* images are broken down into 625 lines.
6. The images from film projectors are directed *by a system of mirrors*.
7. Telecine equipment *originates from* the words television and cinema.
8. The *scanning* method most commonly used today is called interlaced scanning.
9. An image is scanned *line by line from top to bottom*.

10. The top of the image *on the screen* will begin to fade.

11. With interlaced scanning even-numbered lines are scanned *after* odd-numbered lines.

12. The electron beam travels from the top of the screen to the bottom of the screen *twice.*

Text 5

Transmitter

The audio and video signals of a television program are broadcast through the air by a transmitter. The transmitter superimposes the information in the camera's electronic signals onto carrier waves. The transmitter amplifies the carrier waves, making them much stronger, and sends them to a transmitting antenna. This transmitting antenna radiates the carrier waves in all directions, and the waves travel through the air to antennas connected to television sets or relay stations.

The Transmitter

The transmitter superimposes the information from the electronic television signal onto carrier waves by modulating (varying) either the wave's amplitude, which corresponds to the wave's strength, or the wave's frequency, which corresponds to the number of times the wave oscillates each second. The amplitude of one carrier wave is modulated to carry the video signal (amplitude modulation, or AM) and the frequency of another wave is modulated to carry the audio signal (frequency modulation, or FM). These waves are combined to produce a carrier wave that contains both the video and audio information. The transmitter first generates and modulates the wave at a low power of several watts. After modulation, the transmitter amplifies the carrier signal to the desired power level, sometimes many kilowatts (1,000 watts), depending on how far the signal needs to travel, and then sends the carrier wave to the transmitting antenna.

The frequency of carrier waves is measured in hertz (Hz), which is equal to the number of wave peaks that pass by a point every second. The frequency of the modulated carrier wave varies, covering a range or band, of about 4 million hertz or 4 megahertz (4 MHz). This band is much wider than the band needed for radio broadcasting, which is about 10,000 Hz or 10 kilohertz (10 kHz). Television stations that broadcast in the same area send out carrier weaves on different bands of frequencies, each called a channel, so that the signals from different stations do not mix. To accomodate all the channels, which are spaced at least 6 MHz apart, television carrier frequencies are very high. Six MHz does not represent a significant chunk of bandwidth if the television stations broadcast between 50 and 800 MHz.

In the United States and Canada, there are two ranges of frequency bands that cover 67 different channels. The first range is called very high frequency (VHF), and it includes frequencies from 54 to 72 MHz, from 76 to 88 MHz, and from 174 to 216 MHz. These frequencies correspond to channels 2 through 13

on a television set. The second range, ultrahigh frequency (UHF), includes frequencies from 407 MHz to 806 MHz, and it corresponds to channels 14 through 69.

The high-frequency waves radiated by transmitting antennas can travel only in a straight line, and may be blocked by obstacles in between the transmitting and receiving antennas. For this reason, transmitting antennas must be placed on tall buildings or towers. In practice, these transmitters have a range of about 120 km (75 ml). In addition to being blocked, some television signals may reflect off buildings or hills and reach a receiving antenna a little later than the signals that travel directly to the antenna. The result is a ghost, or second image, that appears on the television screen. Television signals may, however, be sent clearly from almost any point on earth to any other – and from spacecraft to earth – by means of cables, microwave relay stations and communications satellites.

Active Vocabulary

band – смуга частот
chunk of bandwidth [bæ̱ndwɪdθ] – блок ширини смуги частот
ghost – тінь, марево
obstacle – перешкода
radiate – випромінювати
superimpose – накладати
transmitter – передавач

Ex. 1. Answer the following questions

1. How are the audio and video signals of a television program broadcast?
2. What does the transmitter amplify?
3. What antennas do the waves travel through the air to?
4. What does the wave's amplitude correspond to?
5. What is frequency modulation?
6. What is the frequency of carrier waves measured in?
7. What is the range of the frequency of the modulated carrier wave?
8. Why do the signals from different stations not mix?
9. How many ranges of frequency bands covering 67 channels are there in the United States and Canada?
10. What does ultrahigh frequency include?
11. In what way can the high-frequency waves radiated by transmitting antennas travel?
12. How may television signals be sent clearly from almost any point on earth to any other?

Ex. 2. Give English equivalents of the following words

бути розташованим
вимірювати
діапазон

канал
модулювання
напрямок
підсилювати
радіорелейна станція мікрохвильового діапазону
частотність

Ex. 3. Read the following sentences and write T for true statements and F for false statements

1. The transmitter superimposes the information in the camera's electronic signals from carrier waves.
2. The transmitter sends the carrier waves to a transmitting antenna.
3. The transmitting antenna radiates the carrier waves in one direction.
4. The amplitude of one carrier wave is modulated to carry the video and audio signals.
5. After modulation, the transmitter amplifies the carrier signal to the desired power level.
6. Hertz is equal to the number of wave peaks that pass by a point every minute.
7. The band for TV broadcasting is much wider than the band needed for radio broadcasting.
8. To accomodate all the channels, television carrier frequencies are very high.
9. Ultrahigh frequency corresponds to channels 1 through 6.
10. The high-frequency waves radiated by transmitting antennas may be blocked by obstacles in between the transmitting and receiving antennas.
11. Transmitting antennas must be placed on low buildings.
12. The reason of a ghost, or second image, is that some television signals may reflect off buildings or hills.

Text 6

Transmission Of Television Signals

Cable Transmission

Cable television was first developed in the late 1940s to serve shadow areas – that is, areas that are blocked from receiving signals from a station's transmitting antenna. In these areas, a community antenna receives the signal, and the signal is then redistributed to the shadow areas by coaxial cable (a large cable with a wire core that can transmit the wide band of frequencies required for television) or, more recently, by fiber-optic cable. Viewers in most areas can now subscribe to a cable television service, which provides a wide variety of television programs and films adapted for television that are transmitted by cable directly to the viewer's television set. Digital data-compression techniques, which convert television signals to digital code in an efficient way, have increased cable's capacity to 500 or more channels.

Microwave Relay Transmission

Microwave relay stations are tall towers that receive television signals, amplify them, and retransmit them as a microwave signal to the next relay station. Microwaves are electromagnetic waves that are much shorter than normal television carrier waves and can travel farther. The stations are placed about 50 km (30 ml) apart. Television networks once relied on relay stations to broadcast to affiliate stations were located in cities far from the original source of the broadcast. The affiliate stations received the microwave transmission and rebroadcast it as a normal television signal to the local area. This system has now been replaced almost entirely by satellite transmission in which networks send or uplink their program signals to a satellite that in turn downlinks the signals to affiliate stations.

Satellite Transmission

Communications satellites receive television signals from a ground station, amplify them, and relay them back to the earth over an antenna that covers a specified terrestrial area. The satellites circle the earth in a geosynchronous orbit, which means they stay above the same place on the earth at all times. Instead of a normal aerial antenna, receiving dishes are used to receive the signal and deliver it to the television set or station. The dishes can be fairly small for home use, or large and powerful, such as those used by cable and network television stations.

Satellite transmissions are used to efficiently distribute television and radio programs from one geographic location to another by networks: cable companies, individual broadcasters, program providers, and industrial, educational and other organizations. Programs intended for specific subscribers are scrambled so that only the intended recipients, with appropriate decoders, can receive the program.

Direct-broadcast satellites (DBS) are used worldwide to deliver TV programming directly to TV receivers through small home dishes. The Federal Communications Commission (FCC) licensed several firms in the 1980s to begin DBS (direct-broadcast satellite) service in the United States. The actual launch of DBS satellites, however, was delayed due to the economic factors involved in developing a digital video compression system. The arrival in the early 1990s of digital compression made it possible for a single DBS satellite to carry more than 200 TV channels. DBS systems in North America are operating in the K_u band (12.0 – 19.0 GHz). DBS home systems consist of the receiving dish antenna and a low-noise amplifier that boosts the antenna signal level and feeds it to a coaxial cable. A receiving box converts the superhigh frequency (SHF) signals to lower frequencies and puts them on channels that the home TV set can display.

Active Vocabulary

affiliate station – ретрансляційна станція ТБ-мережі

boost – підтримувати

coaxial cable [`kəu'æksɪəl] – коаксіальний кабель з додатковим покриттям

community antenna – антена колективного користування

downlink – передача інформації на Землю з борта космічного корабля або штучного супутника

geosynchronous [dʒɪ:ə(u)'sickrənəs] – геостаціонарний

ghost – тінь, марево

intended – передбачуваний

K_u band [keɪju] – діапазон частот від 12 до 18 ГГц

scramble – видиратися, підніматися

shadow area – зона відсутності прийому

terrestrial – земний

wire core – серцевина дроту

Ex. 1. Answer the following questions

1. What was the mission of cable television?
2. What is a coaxial cable?
3. Viewers in most areas cannot now subscribe to a cable television service, can they?
4. How many channels have digital data-compression techniques increased cable's capacity to?
5. What are the functions of microwave relay stations?
6. What is a microwave?
7. How far from each other are relay stations placed?
8. What is meant by satellite transmission?
9. What planet do satellites circle in a geosynchronous orbit?
10. What types of receiving dishes can you name?
11. Whare did the Federal Communications Commission license several firms to begin DBS service?
12. What are direct-broadcast satellites used for?

Ex. 2. Give English equivalents of the following words

абонент, підписчик

відповідний декодер

запуск

затриманий, відкладений

комунальна антена

на віддалі

передача інформації з супутника на Землю

перерозподілятись

пропускна здатність (каналу зв'язку)

рухатися по колу, навколо

телеглядач

цифровий

Ex. 3. Identify the letter that best completes the statement

1. Cable television was first developed in …..
a) 1950s
b) 1930s
c) 1940s

2. A community antenna receives the signal redistributed to the shadow areas by …..
a) communications cable
b) coaxial cable
c) flexible cable

3. Television programs are transmitted by cable directly to the viewer's …..
a) mobile phone
b) television antenna
c) television set

4. Digital data-compression techniques convert ….. signals to digital code.
a) television
b) high
c) green

5. Microwave relay stations retransmit television signals as a ….. to the next relay station.
a) microwave oven
b) microwave circuit
c) microwave signal

6. The microwave transmission is ….. as a normal television signal to the local area.
a) rebroadcast
b) repaired
c) rebuilt

7.) After ampflifying television signals, communications satellites relay them back …..
a) to the space
b) to the earth
c) to the radio

8. ….. dishes are used to deliver the signal to the television set or station.
a) meat
b) receiving
c) main

9. Only specific recipients, with ….. decoders, can receive some special programmes.

a) appropriate
b) iron
c) historical

10. The arrival of digital compression made it possible for a single DBS satellite to carry more than ….. TV channels.

a) two thousand
b) two quarters
c) two hundred

11. A low-noise amplifier boosts the ….. signal level and feeds it to a coaxial cable.

a) modern
b) antenna
c) roof

12. The superhigh frequency signals are put on channels that the home ….. set can display.

a) tea
b) dressing-table
c) television

Text 7

Television Receiver

The television receiver translates the pulses of electric current from the antenna or cable back into images and sound. A traditional television set integrates the receiver, audio system and picture tube into one device. However, some cable TV systems use separate component such as a set top box as a receiver. A high-definition television (HDTV) set integrates the receiver directly into the set like a traditional TV. However, some televisions receive high-definition signals and display them on a monitor. In these instances, an external receiver is required.

Tuner

The tuner blocks all signals other than that of the desired channel. Blocking is done by the radio frequency (RF) amplifier. The RF amplifier is set to amplify a frequency band, 6 MHz wide, transmitted by a television station; all other frequencies are blocked. A channel selector connected to the amplifier determines the particular frequency band that is amplified. When a new channel is selected, the amplifier is reset accordingly. In this way, the band, or channel, picked out by the home receiver is changed. Once the viewer selects a channel, the incoming signal is amplified, and the video, audio and scanning signals are separated from the higher-frequency carrier waves by a process called

demodulation. The tuner amplifies the weak signal intercepted by the antenna and partially demodulates (decodes) it by converting the carrier frequency to a lower frequency – the intermediate frequency. Intermediate-frequency amplifiers further increase the strength of the signals received from the antenna. After the incoming signals have been amplified, audio, scanning and video signals are separated.

Audio System

The audio system consists of a discriminator, which translates the audio portion of the carrier wave back into an electronic audio signal, an amplifier and a speaker. The amplifier strengthens the audio signal from the discriminator and sends it to the speaker, which converts the electrical waves into sound waves that travel through the air to the listener.

Picture Tube

The television picture tube receives video signals from the tuner and translates the signals back into images. The images are created by an electron gun in the back of the picture tube, which shoots a beam of electrons toward the back of the television screen. A black-and-white picture tube contains just one electron gun, while a color picture tube contains three electron guns, one for each of the primary colors of light (red, green and blue). Part of the video signal goes to a magnetic coil that directs the beam and makes it scan the screen in the same manner as the camera originally scanned the scene. The rest of the signal directs the strength of the electron beam as it strikes the screen. The screen is coated with phosphor, a substance that glows when it is struck by electrons. The stronger the electron beam, the stronger the glow and the brighter that section of the scene appears. In color television, a portion of the video signal is used to separate out the three color signals, which are then sent to their corresponding electron beams. The screen is coated by tiny phosphor strips or dots that are arranged in groups of three: one strip or dot that emits blue, one that emits green, and one that emits red. Before light from each beam hits the screen, it passes through a shadow mask located just behind the screen. The shadow mask is a layer of opaque material that is covered with slots or holes. It partially blocks the beam corresponding to one color and prevents it from hitting dots of another color. As a result, the electron beam directed by signals for the color blue can strike and light up only blue dots. The result is similar for the beams corresponding to red and green. Images in the three different colors are produced on the television screen. The eye automatically combines these images to produce a single image having the entire spectrum of colors formed by mixing the primary colors in various proportions.

Active Vocabulary

demodulation – демодуляція, визначення вихідного цифрового або аналогового модулювального сигналу із модульованої аналогової несучої хвилі

discriminator – частотний детектор, пристрій для порівняння або відмінності

intercept – перехопити
magnetic coil – котушка електромагніту
opaque [ə'peɪk] – непрозорий
reset – перезавантажити
set top box – телевізійна приставка
slot – канавка, проріз

Ex. 1. Answer the following questions

1. What is the function of the television receiver?
2. What does a traditional television set integrate into one device?
3. Where do some televisions display high-definition signals?
4. What happens when a new channel is selected?
5. What does the tuner demodulate the weak signal by?
6. When are audio, scanning and video signals separated?
7. What does the audio system consist of?
8. Does the amplifier strengthen the audio signal from the discriminator or from the speaker?
9. Where are the images created?
10. What electron guns does a color picture tube contain?
11. What is the screen coated with?
12. What is the function of the shadow mask?

Ex. 2. Give English equivalents of the following words

діапазон частот
електронний прожектор
зовнішній приймач
монітор
сигнал, що надходить
речовина
розшифрувати
світитися
спрямовувати
тіньова маска кінескопа

Ex. 3. Read the text "Computer and Internet Integration" and make up twelve questions

As online computer systems become more popular, televisions and computers are increasingly integrated. Such technologies combine the capabilities of personal computers, television, DVD players, and in some cases telephones, and greatly expand the kinds of services that can be provided. For example, computer-like hard drives in set-top recorders automatically store a TV program as it is being received so that the consumer can pause live TV, replay a scene, or skip ahead. For programs that consumers want to record for future viewing, a hard drive makes it possible to store a number of shows. Some set-

top devices offer Internet access through a dial-up modern or broadband connection. Others allow the consumer to browse the World Wide Web on their TV screen. When a device has both a hard drive and a broadband connection, consumers may be able to download a specific program, opening the way for true video on demand.

Consumers may eventually need only one system or device, known as an information appliance, which they could use for entertainment, communication, shopping and banking in the convenience of their home.

Text 8

Latest Development Of Television

Colour Television

It was realized as early as 1904 that color television was possible using the three primary colors of light: red, green and blue. In 1928 Baird demonstrated color television using a Nipkow disk in which three sets of openings scanned the scene. A fairly refined color television system was introduced in New York City in 1940 by the Hungarian-born American inventor Peter Goldmark. In 1951 public broadcasting of color television was begun using Goldmark's system. However, the system was incompatible with monochrome television, and the experiment was dropped at the end of the year. Compatible color television was perfected in 1953, and public broadcasting in color was revived a year later.

Other developments that improved the quality of television were larger screens and better technology for broadcasting and transmitting television signals. Early television screens were either 18 or 25 cm (7 or 10 in) diagonally across. Television screens now come in a range of sizes. Those that use built-in cathode-ray tubes (CRTs) measure as large as 89 or 100 cm (35 or 40 in) diagonally. Projection televisions (PTVs), first introduced in the 1970s, now come with screens as large as 2 m (7 ft) diagonally. The most common are rear-projection sets in which three CRTs beam their combined light indirectly to a screen via an assembly of lenses and mirrors. Another type of PTV is the front-projection set, which is set up like a motion picture projector to project light across a room to a separate screen that can be as large as a wall in a home allows. Newer types of PTVs use liquid-crystal display (LCD) technology or an array of micro mirrors, also known as a digital light processor (DLP), instead of cathode-ray tubes. Manufacturers have also developed very small, portable television sets with screens that are 7.6 cm (3 in) diagonally across.

Television in Space

Television evolved from an entertainment medium to a scientific medium during the exploration of outer space. Knowing that broadcast signals could be sent from transmitters in space, the National Aeronautics and Space Administration (NASA) began developing satellites with television cameras. Unmanned spacecraft of the Ranger and Surveyor series relayed thousands of close-up pictures of the moon's surface back to earth for scientific analysis and preparation for lunar landings. The successful U.S. manned landing on the moon

in July 1969 was documented with live black-and-white broadcasts made from the surface of the moon. NASA's use of television helped in the development of photosensitive camera lenses and more sophisticated transmitters that could send images from a quarter-million miles away.

Since 1960 television cameras have also been used extensively on orbiting weather satellites. Video cameras trained on Earth record pictures of cloud cover and weather patterns during the day, and infrared cameras (cameras that record light waves radiated at infrared wavelengths) detect surface temperatures. The ten Television Infrared Observation Satellites (TIROS) launched by NASA paved the way for the operational satellites of the Environmental Science Services Administration (ESSA), which in 1970 became a part of the National Oceanic and Atmospheric Administration (NOAA). The pictures returned from these satellites aid not only weather prediction but also understanding of global weather systems. High-resolution cameras mounted in Landsat satellites have been successfully used to provide surveys of crop, mineral and marine resources.

Digital Television

Digital television receivers, which convert the analog or continuous electronic television signals received by an antenna into an electronic digital code (a series of ones and zeros), are currently available. The analog signal is first sampled and stored as a digital code, then processed, and finally retrieved. This method provides a cleaner signal that is less vulnerable to distortion, but in the event of technical difficulties, the viewer is likely to receive no picture at all rather than the degraded picture that sometimes occurs with analog reception. The difference in quality between digital television and regular television is similar to the difference between a compact disc recording (using digital technology) and an audiotape or long-playing record.

The high-definition television (HDTV) system was developed in the 1980s. It uses 1,080 lines and a wide-screen format, providing a significantly clearer picture than the traditional 525- and 625-line television screens. Each line in HDTV also contains more information than normal formats. HDTV is transmitted using digital technology. Because it takes a huge amount of coded information to represent a visual image-engineers believe HDTV will need about 30 million bits (ones and zeros of the digital code) each second – data-compression techniques have been developed to reduce the number of bits that need to be transmitted. With these techniques, digital systems need to continuously transmit codes only for a scene in which images are changing; the systems can compress the recurring codes for images that remain the same (such as the background) into a single code. Digital technology is being developed that will offer sharper pictures on wider screens, and HDTV with cinema-quality images.

A fully digital system was demonstrated in the United States in the 1990s. A common world standard for digital television, the MPEG-2, was agreed on in April 1993 at a meeting of engineers representing manufacturers and

broadcasters from 18 countries. Because HDTV receivers initially cost much more than regular television sets, and broadcasts of HDTV and regular television are incompatible, the transition from one format to the next could take many years. The method endorsed by the U.S. Congress and the FCC to ease this transition is to give existing television networks a second band of frequencies on which to broadcast, allowing networks to broadcast in both formats at the same time. Engineers are also working on making HDTV compatible with computers and telecommunications equipment so that HDTV technology may be applied to other systems besides home television, such as medical devices, security systems and computer-aided manufacturing (CAM).

Active Vocabulary

assembly – комплект, монтаж
bulky – громіздкий
detect – виявляти
endorsed – схвалений
incompatible – несумісний
monochrome – чорно-білий
pave – вистилати
recurring [ri'kɛ:riŋ] – поточний
retrieve – відновити
sophisticated – ускладнений, сучасний
state-of-the-art – найсучасніший
surround-sound – високоякісний звукозапис, який створює ефект просторового відтворення звуку

Ex. 1. Answer the following questions

1. Who introduced a fairly refined color television system?
2. Why was the usage of Goldmark's system unsuccessful?
3. Whae was public broadcasting in color revived?
4. What was the size of early television screens?
5. How do cathode-ray tubes beam their combined light to a screen?
6. Why did the National Aeronautics and Space Administration begin developing satellites with television cameras?
7. What helped to document the U.S. manned landing on the moon in July 1969?
8. What are television cameras used on orbiting weather satellites for?
9. What is the function of digital television receivers?
10. Is there any difference in quality between digital and regular television?
11. Why was each second-data-compression techniques useful?
12. Where may the high-definition television technology be applied?

Ex. 2. Read the text "Flat Panel Display" and fill in the blanks with appropriate words

Hung, light, LCD, centimeters, inert, substance, screens, laptop, electricity, flat, thinner, tube.

In addition to getting clearer, televisions are also getting 1) …… Flat panel displays, some just a few 2) ….. thick, offer an alternative to bulky cathode ray 3) ….. televisions. Even the largest flat panel display televisions are thin enough to be 4) ….. on the wall like a painting. Many flat panel TVs use liquid-crystal display (5) …..) screens that make use of a special 6) ….. that changes properties when a small electric current is applied to it. LCD technology has already been used extensively in 7) ….. computers. LCD television screens are 8) ….., use very little 9) ….., and work well for small, portable television sets. LCD has not been as successful, however, for larger television 10) …...

Flat panel TVs made from gas-plasma displays can be much larger. In gas-plasma displays, a small electric current stimulates an 11) ….. gas sandwiched between glass panels, including one coated with phosphors that emits 12) ….. in various colors. While just 8 cm thick, plasma screens can be more than 150 cm diagonally.

Ex. 3. Read the text "Home Recording" and make up twelve questions

In time, the process of watching images on a television screen made people interested in either producing their own images or watching programming at their leisure, rather than during standard broadcasting times. It became apparent that programming on videotape – which had been in use since the 1950s – could be adapted for use by the same people who were buying televisions. Affordable videocassette recorders (VCR) were introduced in the 1970s and in the 1980s became almost as common as television sets.

During the late 1990s and early 2000s the digital video disc (DVD) player had the most successful product launch in consumer electronics history. According to the Consumer Electronics Association (CEA), which represents manufacturers and retailers of audio and video products, 30 million DVD players were sold in the United States in a record five-year period from 1997 to 2001. It took compact disc (CD) players 8 years and VCRs 13 years to achieve that 30-million milestone. The same size as a CD, a DVD can store enough data to hold a full-length motion picture with a resolution twice that of a videocassette. The DVD player also offered the digital surround-sound quality experienced in a state-of-the-art movie theater. Beginning in 2001 some DVD players also offered home recording capability.

Ex. 4. Prepare reports using Internet or other sources (catalogues, magazines, books, etc.) about the latest news, achievements in the field concerning the topic of the unit

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ТЕРМІНОЗНАВСТВО: РАДІОТЕХНІКА І ТЕЛЕКОМУНІКАЦІЇ ЧАСТИНА 2

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