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WHAT IS TELECOMMUNICATION?

The methodological manual for the second and third year students on the specialty of telecommunication

(5311300)

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“What is Telecommunication?” the educational methodological manual for the second and third year students on the specialty of telecommunication. (5311300)

KIRISH

Ushbu uslubiy qo’llanma “Telecommunicatsiya” yo’nalishi 3-kurs talabalarining og’zaki nutq, yozma tarjima va ingliz tili da berlgan asl matnlarni o’qish va tushunish mahoratlarini oshirish maqsadida auditoriyada va mustaqil ishlash uchun tuzilgan bo’lib, 2 bolim - 8 ta dars hamda uyda o’qish uchun mo’ljallangan qo’shimcha matnlardan tashkil topgan. Uslubiy qo’llanmaga telecommunikatsiya tarixi, uning ilk davrlariga oid dolzarb matnlarning asl nusxasi kiritilganligi talabalarning ushbu sohaga oid maxsus atamalarni yaxshi o’zlashtirishiga va tarjima mahoratini oshirishga yordam beradi. Matnlarga oid berilgan mashqlar talabalarning o’rganilgan matn bo’yicha ijodiy fikrlash qobiliyatini oshiradi va ularni o’z fikrlarini erkin ifodalashga o’rgatadi.Har bir darsga berilgan yangi so’zlarning muqobillari uslubiy qo’llanma bilan ishlashda matnlarni yanada yaxshiroq tushunish imkonini beradi.Uslubiy qo’llanmada har bir dars uchun berilgan yangii so’zlarga oid mashqlar talabalarning lug’at boyligini osirishga, hamda sohaga oid atamalrni puhtaroq egallashga yordam beradi. Har bir darsda berilgan oq’zaki nutq uchun matnlar talabalarning erkin fikrlash va gapirish qobiliyatini, tarjima qilish mahoratini, o’qish texnikasini oshiradi, ularning bilimini mustahkamlaydi.

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UNIT I

LESSON 1

GLOSSARY

involve - have or include (something) as a necessary or integral part or result

beacon - a fire or light set up in a high or prominent position as a warning, signal, or celebration

drumbeat - stroke or pattern of strokes on a drum

whistle- a clear, high-pitched sound made by forcing breath through a small hole between partly closed lips, or between one's teeth

device - a thing made or adapted for a particular purpose, especially a piece of mechanical or electronic equipment

fiber optics - the use of thin flexible fibres of glass or other transparent solids to transmit light signals, chiefly for telecommunications or for internal inspection of the body

wireless - a system by which messages are sent over a distance by radio signals communicating without connecting wires or other material contacts

include - make part of a whole or set

increasingly - you can use increasingly to indicate that a situation or quality is becoming greater in intensity or more common

revenue the income accruing from taxation to a government during a specified period of time, usually a year 2

estimate- roughly calculate or judge the value, number, quantity, or extent of

Task I. Read the text and make up some questions to the text.

WHAT IS TELECOMMUNICATION?

Telecomunication is the transmission of information.

In earlier times, telecommunications involved the use of visual signals, such as beacons, smoke signals, semaphore telegraphs, signal flags, and optical heliographs, or audio messages such as coded drumbeats, lung-blown horns, and loud whistles. In modern times, telecommunications involves the use of electrical devices such as the telegraph, telephone, and teleprinter, as well as the use of radio and microwave communications, as well as fiber optics and their associated electronics, plus the use of the orbiting satellites and the Internet. A revolution in wireless telecommunications began in the 1900s (decade) with pioneering developments in wireless radio communications by Nikola Tesla and Guglielmo Marconi. Marconi won the Nobel Prize in Physics in 1909 for his efforts. Other highly notable pioneering inventors and developers in the field of electrical and electronic telecommunications include Charles Wheatstone and Samuel Morse (telegraph), Alexander Graham Bell (telephone), Edwin Armstrong, and Lee de Forest (radio), as well as John Logie Baird and Philo Farnsworth (television).The world's effective capacity to exchange information through two-way telecommunication networks grew from 281 petabytes of (optimally compressed)

information in 1986, to 471 petabytes in 1993, to 2.2 (optimally compressed) exabytes in 2000, and to 65 (optimally compressed) exabytes in 2007. This is the informational equivalent of 2 newspaper pages per person per day in 1986, and 6 entire newspapers per person per day by 2007. Given this growth, telecommunications play an increasingly important role in the world economy and the worldwide telecommunication industry's revenue was estimated to be $3.85 trillion in 2008. The service revenue of the global telecommunications industry was estimated to be $1.7 trillion in 2008, and is expected to touch $2.7 trillion by 2013.

Task II. Answer the following questions:

1. What is telecommunication?
2. What were early time telecommunications?
3. What can you say about modern time telecommunications?
4. Who were pioneers of wireless telecommunications?
5. What inventors and developers in the field of electrical and electronic telecommunications do you know?
6. When Marconi won the Nobel Prize?
7. What can you say about income of telecommunication in the economy?

Task III. Match the followings:

1.	Lawyer	b. substance used for medical purposes
2.	Show	c. break in on (person speaking, doing something, etc)
3.	Documentary	d. person who practices law
4.	Drug	e. against members of other races
5.	Prejudice	f. kind of public entertainment, e.g. circus, theatre, on radio, TV, etc.
6.	Interrupt	g. describing ideas, social topics, studies of the natural world, science, etc.

Task IV. Put the jumbled part of the sentences in the right order:

1. Documentary, kind, the, is, program, another, television, commercial, of,
2. Many, shows, talk, broadcast, commercial, stations, television
3. Television, makes, commercial, up, of, Advertising, part, important, an
4. Service, public, a, provides, advertising, TV, a, of, percentage, small
5. Poor, claim, is, also, entertainment, the, quality, critics, of, the, that, of, much
6. Viewers, must, attract, numbers, the, of, programs, large

LESSON 2

GLOSSARY

adapt - make (something) suitable for a new use or purpose; modify
compound- a thing that is composed of two or more separate elements; a mixture
invent create or design (something that has not existed
hydraulic - denoting or relating to a liquid moving in a confined space under pressure
semaphore - a system of sending messages by holding the arms or two flags or poles in certain positions according to an alphabetic code
vessel- a ship or large boat
utilize- make practical and effective use of
deploy- move (troops) into position for military action
visibility - the state of being able to see or be seen
hilltops - the summit of a hill
relay - receive and pass on (information or a message)
arrival - the action or process of arriving
warship - a ship equipped with weapons and designed to take part in warfare at sea
chain - a series of linked metal rings used for fastening or securing something, or for pulling loads
Lille - an industrial city in northern France, near the border with Belgium; pop. 184,493 (1999)
abandon- complete lack of inhibition or restraint
replica- an exact copy or model of something, especially one on a smaller scale

Task I. Read the text and make up some questions to the text.

ETYMOLOGY AND HISTORY OF TELECOMMUNICATIONS

The word telecommunication was adapted from the French word télécommunication. It is a compound of the Greek prefix tele- (τηλε-), meaning "far off", and the Latin communicare, meaning "to share". The French word télécommunication was first invented in the French Grande Ecole "Telecom ParisTech" formerly known as "Ecole nationale superieure des telecommunications" in 1904 by the French engineer and novelist Édouard Estaunié.

Greek hydraulic semaphore systems were used as early as the 4th century BC. The hydraulic semaphores, which worked with water filled vessels and visual signals, functioned as optical telegraphs. However, they could only utilize a very limited range of pre-determined messages, and as with all such optical telegraphs could only be deployed during good visibility conditions.

During the Middle Ages, chains of beacons were commonly used on hilltops as a means of relaying a signal. Beacon chains suffered the drawback that they could only pass a single bit of information, so the meaning of the message such as "the enemy has been sighted" had to be agreed upon in advance. One notable instance of their use was during the Spanish Armada, when a beacon chain relayed

a signal from Plymouth to London that signaled the arrival of the Spanish warships.

Task II. Answer the questions.

1. What does the word telecommunication mean?
2. When were Greek hydraulic semaphore systems used?
3. How did Greek hydraulic semaphore systems work?
4. What was used as a means of relaying a signal?
5. What did Beacon chains suffer from?

Task III. Fill in the gaps with the appropriate words.

Hilltops, adapt, water ,optical ,utilize ,messages, use, vessels ,chains.

1. Greek hydraulic semaphore systems were ….. as early as the 4th century BC.
2. The word telecommunication was …. from the French word telecommunication.
3. The hydraulic semaphores, which worked with …. filled ….and visual signals, functioned as…. telegraphs.
4. During the Middle Ages ….of beacons were commonly used on …as a means of relaying a signal.
5. However, they could only … a very limited range of pre-determined …. .

Interesting facts:

Systems since the Middle Ages

A replica of one of Chappe's semaphore towers in Nalbach.In 1792, Claude Chappe, a French engineer, built the first fixed visual telegraphy system (or semaphore line) between Lille and Paris. However semaphore systems suffered from the need for skilled operators and the expensive towers at intervals of 10–30 kilometers (6–20 mi). As a result of competition from the electrical telegraph, Europe's last commercial semaphore line in Sweden was abandoned in 1880.

LESSON 3

GLOSSARY

improvement- a thing that makes something better or is better than something else

develop - grow or cause to grow and become more mature, advanced, or elaborate

contribution - a gift or payment to a common fund or collection

advance - make or cause to make progress:

complicated - consisting of many interconnecting parts or elements; intricate

significantly - sufficiently great or important to be worthy of attention; noteworthy

anticipated -if an event, especially a cultural event, is eagerly anticipated, people expect that it will be very good, exciting, or interesting.

efficient (of a system or machine) achieving maximum productivity with minimum wasted effort or expense

explanation - a statement or account that makes something clear

purely - in a pure manner

empirically - based on, concerned with, or verifiable by observation or experience rather than theory or pure logic

successfully - something that is successful achieves what it was intended to achieve.

completed-having all the necessary or appropriate parts

lay -[with obj. and adverbial of place] put (something) down gently or carefully she laid the baby in his cot ■ [with obj.] prevent (something) from rising off the ground there may have been the odd light shower just to lay the dust ■ [with obj.] cause (a ghost) to stop appearing; exorcize: we need to lay the ghost of the past and condemn Nazism 2) [with obj.] put down and set in position for use it is advisable to have your carpet laid by a professional

replacement-the act or process of replacing

communication- the imparting or exchanging of information by speaking, writing, or using some other medium ..

transatlantic- Transatlantic flights or signals go across the Atlantic Ocean, usually between the United States and Britain.

cable - a thick rope of wire or hemp used for construction, mooring ships, and towing vehicles

evolve - develop gradually: [no obj] the company has evolved into a major chemical manufacturer

Task I.Read the text and give the main points.

TELEGRAPH AND TELEPHONE

PART I

The first commercial electrical telegraph was constructed by Sir Charles Wheatstone and Sir William Fothergill Cooke, and its use began on April 9, 1839. Both Wheatstone and Cooke viewed their device as "an improvement to the [already-existing, so-called] electromagnetic telegraph" not as a new device. The businessman Samuel F.B. Morse and the physicist Joseph Henry of the United

States developed their own, simpler version of the electrical telegraph, independently. Morse successfully demonstrated this system on September 2, 1837. Morse's most important technical contribution to this telegraph was the rather simple and highly efficient Morse Code, which was an important advance over Wheatstone's complicated and significantly more expensive telegraph system. The communications efficiency of the Morse Code anticipated that of the Huffman code in digital communications by over 100 years, but Morse and his associate Alfred Vail developed the code purely empirically, unlike Huffman, who gave a detailed theoretical explanation of how his method worked.

The first permanent transatlantic telegraph cable was successfully completed on 27 July 1866, allowing transatlantic electrical communication for the first time. An earlier transatlantic cable had operated for a few months in 1859, and among other things, it carried messages of greeting back and forth between President James Buchanan of the United States and Queen Victoria of the United Kingdom.

However, that transatlantic cable failed soon, and the project to lay a replacement line was delayed for five years by the American Civil War. Also, these transatlantic cables would have been completely incapable of carrying telephone calls even had the telephone already been invented. The first transatlantic telephone cable (which incorporated hundreds of electronic amplifiers) was not operational until 1956.

Task II.Match the words.

1.	abandon	a	a thing made or adapted for a particular purpose,
2.	beacon	b	make practical and effective use of
3.	utilize	c	complete lack of inhibition or restraint
4.	device	d	a fire or light set up in a high or prominent position as a warning,
5.	wireless	e	a gift or payment to a common fund or collection
6.	contribution	f	have or include (something) as a necessary or integral part or result
7.	estimate	g	grow or cause to grow and become more mature, advanced, or elaborate
8.	chain	h	roughly calculate or judge the value, number, quantity, or extent of
9.	develop	i	a system by which messages are sent over a distance by

			radio signals communicating without connecting wires
10	Involve	j	a series of linked metal rings

Task III. Read the next part of the text and translate it.

PART II

The conventional telephone now in use worldwide was first patented by Alexander Graham Bell in March 1876. That first patent by Bell was the *master patent* of the telephone, from which all other patents for electric telephone devices and features flowed. Credit for the invention of the electric telephone has been frequently disputed, and new controversies over the issue have arisen from time-to-time. As with other great inventions such as radio, television, the light bulb, and the digital computer, there were several inventors who did pioneering experimental work on *voice transmission over a wire*, and then they improved on each other's ideas. However, the key innovators were Alexander Graham Bell and Gardiner Greene Hubbard, who created the first telephone company, the Bell Telephone Company in the United States, which later evolved into American Telephone & Telegraph (AT&T).

The first commercial telephone services were set up in 1878 and 1879 on both sides of the Atlantic in the cities of New Haven, Connecticut, and London, England.

Task IV. Find True or False statements.

1. The conventional telephone now in use worldwide was first patented by Alexander Graham Bell in May 1866.
2. The first commercial telegraph services were set up in 1877 and 1879.
3. The first patent by Bell was the *master patent* of the telephone.
4. Alexander Graham Bell and Gardiner Greene Hubbard created the first telephone company.
5. The key innovators were Alexander Graham Bell and Marconi.
6. The first commercial electrical telegraph was constructed by Sir Charles Wheatstone and Sir William Fothergill Cooke.
7. The scientist Samuel F.B. Morse and the businessman Joseph Henry of the United States developed their own, simpler version of the electrical telegraph, independently.
8. The first permanent transatlantic telegraph cable was successfully completed on 27 June 1866.
9. An earlier transatlantic cable had operated for a few months in 1859.
10. The first transatlantic telephone cable (which incorporated hundreds of electronic amplifiers) was not operational until 1956.

LESSON 4.

GLOSSARY

conductive - a conductive substance is able to conduct things such as heat and electricity.

transmission - the action or process of transmitting something or the state of being transmitted

medium - the main means of mass communication (television, radio, and newspapers

earn- if you earn something such as praise, you get it because you deserve it.

small-scale - a small-scale activity or organization is small in size and limited in extent.

rely - depend on with full trust or confidence

fast - moving or capable of moving at high speed rotating- revolving around a central axis, line, or point

broadcast - a radio or television programme or transmission

cathode - the negatively charged electrode by which electrons enter an electrical device. The opposite of anode ■ the positively charged electrode of an electrical device, such as a primary cell, that supplies current

ray- the straight line in which light or other electromagnetic radiation travels to a given point

tube - a sealed container, typically of glass and either evacuated or filled with gas, containing two electrodes between which an electric current can be made to flow ■ a cathode ray tube, especially in a television set

application The application of a rule or piece of knowledge is the use of it in a particular situation.

establish- set up on a firm or permanent basis the scheme was established in 1975

appliance a device or piece of equipment designed to perform a specific task

tool - a device or implement, especially one held in the hand, used to carry out a particular function

Task I. Read the text and make up 8 questions to the text.

RADIO AND TELEVISION

In 1832, James Lindsay gave a classroom demonstration of wireless telegraphy via conductive water to his students. By 1854, he was able to demonstrate a transmission across the Firth of Tay from Dundee, Scotland, to Woodhaven, a distance of about two miles (3 km), again using water as the transmission medium.[In December 1901, Guglielmo Marconi established wireless communication between St. John's, Newfoundland and Poldhu, Cornwall (England), earning him the Nobel Prize in Physics for 1909, one which he shared with Karl Braun. However *small-scale* radio communication had already been demonstrated in 1893 by Nikola Tesla in a presentation before the National Electric Light Association.

On March 25, 1925, John Logie Baird of Scotland was able to demonstrate the transmission of moving pictures at the Selfridge's department store in London, England. Baird's system relied upon the fast-rotating Nipkow disk, and thus it became known as the mechanical television. It formed the basis of experimental broadcasts done by the British Broadcasting Corporation beginning September 30, 1929. However, for most of the 20th century, television systems were designed around the cathode ray tube, invented by Karl Braun. The first version of such an electronic television to show promise was produced by Philo Farnsworth of the United States, and it was demonstrated to his family in Idaho on September 7, 1927.Television, however, is not solely a technology, limited to its basic and practical application. It functions both as an appliance, and also as a means for social story telling and message dissemination. It is a cultural tool that provides a communal experience of receiving information and experiencing fantasy. It acts as a "window to the world" by bridging audiences from all over through programming of stories, triumphs, and tragedies that are outside of personal experiences.

Task II. Fill in the gaps using the words in the box.

department demonstrate London. demonstrated December disk system television demonstration water communication wireless

1. On March 25, 1925, John Logie Baird of Scotland was able to ….. the transmission of moving pictures at the Selfridge's …… store in …. .
2. In ….. 1901, Guglielmo Marconi established ….. communication between St. John's, Newfoundland and Poldhu, Cornwall (England).
3. Baird's …. relied upon the fast-rotating Nipkow …. , and thus it became known as the mechanical …. .
4. In 1832, James Lindsay gave a classroom …. of wireless telegraphy via conductive …. to his students.
5. However *small-scale* radio …. had already been…. in 1893 by Nikola Tesla.

Task III. Make a summary to the text.

Task IV. Discuss the following topics with the class.

1. The role of radio and TV in our life. Compare these two devices.
2. Advantages and disadvantages of telephone.

Digital cinema.Realization and demonstration, on October 29th, 2001, of the first digital cinema transmission by satellite in Europe of a feature film by Bernard Pauchon, Alain Lorentz, Raymond Melwig, Philippe Binant.

LESSON 5.

GLOSSARY

receive- be given, presented with, or paid (something) the band will receive a £100,000 advance | she received her prize from the manager ■ take delivery of (something sent or communicated)

mainframe a large high-speed computer, especially one supporting numerous workstations or peripherals

remote - (of an electronic device) operating or operated at a distance by means of radio or infrared signals

"dumb terminals"- (of a computer terminal) able only to transmit data to or receive data from a computer; having no independent processing capability. Often contrasted with intelligent

remain - to stay behind or in the same place

research- the systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions

allow- let (someone) have or do something: [

a four-node - a piece of equipment, such as a computer or peripheral, attached to a network

network- a number of interconnected computers, machines, or operations

emerge - move out of or away from something and become visible

merge- if one thing merges with another, or is merged with another, they combine or come together to make one whole thing. You can also say that two things merge, or are merged.

local area networks- network that links devices within a building or group of adjacent buildings, especially one with a radius of less than 1 km

token ring- a local area network in which a node can transmit only when in possession of a sequence of bits (called the token) that is passed to each node in turn

protocol- a set of rules governing the exchange or transmission of data between devices

inspired- If someone or something inspires you to do something new or unusual, they make you want to do it.

Issue - an important topic or problem for debate or discussion

Task I. Read the text and translate it.

COMPUTER NETWORKS AND THE INTERNET

On 11 September 1940, George Stibitz was able to transmit problems using teleprinter to his Complex Number Calculator in New York and receive the computed results back at Dartmouth College in New Hampshire. This configuration of a centralized computer or mainframe computer with remote "dumb terminals" remained popular throughout the 1950s and into the 1960s. However, it was not until the 1960s that researchers started to investigate packet switching — a technology that allows chunks of data to be sent between different computers without first passing through a centralized mainframe. A four-node network emerged on December 5, 1969. This network soon became the ARPANET, which by 1981 would consist of 213 nodes.

ARPANET's development centred around the Request for Comment process and on 7 April 1969, RFC 1 was published. This process is important because ARPANET would eventually merge with other networks to form the Internet, and

many of the communication protocols that the Internet relies upon today were specified through the Request for Comment process. In September 1981, RFC 791 introduced the Internet Protocol version 4 (IPv4) and RFC 793 introduced the Transmission Control Protocol (TCP) — thus creating the TCP/IP protocol that much of the Internet relies upon today.

However, not all important developments were made through the Request for Comment process. Two popular link protocols for local area networks (LANs) also appeared in the 1970s. A patent for the token ring protocol was filed by Olof Soderblom on October 29, 1974, and a paper on the Ethernet protocol was published by Robert Metcalfe and David Boggs in the July 1976 issue of *Communications of the ACM*. The Ethernet protocol had been inspired by the ALOHAnet protocol which had been developed by electrical engineering researchers at the University of Hawaii.

Task II. Put the verbs in the correct tense and voice.

1. George Stibitz (to be able) to transmit problems using teleprinter to his Complex Number Calculator in New York.
2. A four-node network (to emerge) on December 5, 1969.
3. Not all important developments (to make) through the Request for Comment process.
4. This network soon (to become) the ARPANET, which by 1981 would consist of 213 nodes.
5. A patent for the token ring protocol (to file) by Olof Soderblom on October 29, 1974
6. In September 1981, RFC 791(to introduce) the Internet Protocol version 4 (IPv4) and RFC 793 introduced the Transmission Control Protocol (TCP)
7. The Ethernet protocol (to inspire) by the ALOHAnet protocol

Task III. Discuss the following topic with the class.

1. Using Computer during classes
2. Advantages and disadvantages of Internet.

Task IV. Summarize the text.

LESSON 6

GLOSSARY

consist - Something that consists of particular things or people is formed from them.

primary- 1) of chief importance; principal the government's primary aim is to see significant reductions in unemployment 2) earliest in time or order the primary stage of socialism

unit - a device that has a specified function, especially one forming part of a complex mechanism the gearbox and transmission unit

transmitter- a transmitter is a piece of equipment that is used for broadcasting television or radio programmes.

convert - change the form, character, or function of something

amplifier- an electronic device for increasing the amplitude of electrical signals, used chiefly in sound reproduction

transmission - 1) the action or process of transmitting something or the state of being transmitted the transmission of the HIV virus ■ a program or signal that is broadcast or sent out television transmissions 2) the mechanism by which power is transmitted from an engine to the wheels of a motor vehicle

medium - a means by which something is communicated or expressed

receiver- a piece of radio or television apparatus that detects broadcast signals and converts them into visible or audible form

duplex- something having two parts, in particular

interface- The interface between two subjects or systems is the area in which they affect each other or have links with each other.

destination- the place to which someone or something is going or being sent

transceiver - a device that can both transmit and receive communications, in particular a combined radio transmitter and receiver

circuitry - 1) the design of an electrical circuit 2) the system of circuits used in an electronic device

to cooperate – If you co-operate with someone, you work with them or help them for a particular purpose.

to share - If you share something with another person, you both have it, use it, or occupy it.

point-to-point communication - from one place to the next without stopping or changing; direct ■ (of a telecommunication or computer link) directly from the sender to the receiver

multiple having or involving several parts, elements, or members

multiplex - a system or signal involving simultaneous transmission of several messages along a single channel of communication

Task I. Read the text and translate it.

BASIC ELEMENTS OF TELECOMMUNICATION.

- A basic telecommunication system consists of three primary units that are always present in some form:
- A transmitter that takes information and converts it to a signal.
- A transmission medium, also called the "physical channel" that carries the signal. An example of this is the "free space channel".
- A receiver that takes the signal from the channel and converts it back into usable information.

For example, in a radio broadcasting station the station's large power amplifier is the transmitter; and the broadcasting antenna is the interface between the power amplifier and the "free space channel". The free space channel is the transmission medium; and the receiver's antenna is the interface between the free space channel and the receiver. Next, the radio receiver is the destination of the radio signal, and this is where it is converted from electricity to sound for people to listen to.

Sometimes, telecommunication systems are "duplex" (two-way systems) with a single box of electronics working as both a transmitter and a receiver, or a

transceiver. For example, a cellular telephone is a transceiver. The transmission electronics and the receiver electronics in a transceiver are actually quite independent of each other. This can be readily explained by the fact that radio transmitters contain power amplifiers that operate with electrical powers measured in the watts or kilowatts, but radio receivers deal with radio powers that are measured in the microwatts or nanowatts. Hence, transceivers have to be carefully designed and built to isolate their high-power circuitry and their low-power circuitry from each other.

Telecommunication over telephone lines is called point-to-point communication because it is between one transmitter and one receiver. Telecommunication through radio broadcasts is called broadcast communication because it is between one powerful transmitter and numerous low-power but sensitive radio receivers.

Telecommunications in which multiple transmitters and multiple receivers have been designed to cooperate and to share the same physical channel are called multiplex systems.

Task II. Answer the questions according to the text.

1. What are the primary units of telecommunication system?
2. What can you say about radio broadcasting station?
3. What is the radio receiver?
4. What is the point to point telecommunication?
5. What does duplex mean?
6. What is called multiplex systems?

Task III. Match the words.

1.	medium	a)	a device that can both transmit and receive communications
2.	transceiver	b)	a device that has a specified function
3.	amplifier	c)	a means by which something is communicated or expressed
4.	unit	d)	a piece of equipment that is used for broadcasting television or radio programmes
5.	convert	e)	an electronic device for increasing the amplitude
6.	transmitter-	f)	change the form, character, or function of something

Task IV. Fill in with appropriate prepositions.

- A basic telecommunication system consists **….** three primary units that are always present **….** some form.

- This can be readily explained **….** the fact that radio transmitters contain power amplifiers.
- Telecommunication **….** telephone lines is called point- **….** -point communication.
- A receiver that takes the signal **….** the channel and converts it back **….** usable information.
- The transmission electronics and the receiver electronics **….** a transceiver are actually quite independent **….** each other.
- The receiver's antenna is the interface **….** the free space channel and the receiver.

LESSON 7

GLOSSARY

analog - relating to or using signals or information represented by a continuously variable physical quantity such as spatial position or voltage.

digital- relating to or using signals or information represented by discrete values of a physical quantity such as voltage or magnetic polarization

discrete - individually separate and distinct

value - the regard that something is held to deserve; the importance, worth, or usefulness of something your support is of great value

reception - the action or process of receiving something sent, given, or inflicted

output- the amount of something produced by a person, machine, or industry

random - sample or method is one in which all the people or things involved have an equal chance of being chosen.

additive - characterized by, relating to, or produced by addition

disturbance - the interruption of a settled and peaceful condition

exceed - be greater in number or size than (a quantity, number, or other measurable thing)

amplify - increase the volume of (sound), especially using an amplifier

attenuation - 1) the act of attenuating or the state of being attenuated 2) the loss of energy suffered by radiation as it passes through matter, esp as a result of absorption or scattering

render - provide or give (a service, help, etc.)

indistinguishable- not able to be identified as different or distinct

Task I. Read the text and make up 6-8 questions and discuss them with the group.

ANALOG VERSUS DIGITAL COMMUNICATIONS

Communications signals can be either by analog signals or digital signals. There are analog communication systems and digital communication systems. For an analog signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (for example, a set of ones and zeros). During the propagation and reception, the information contained in analog signals will inevitably be degraded by undesirable

physical noise. (The output of a transmitter is noise-free for all practical purposes.) Commonly, the noise in a communication system can be expressed as adding or subtracting from the desirable signal in a completely random way. This form of noise is called ***"additive noise"***, with the understanding that the noise can be negative or positive at different instants of time. Noise that is not additive noise is a much more difficult situation to describe or analyze, and these other kinds of noise will be omitted here.

On the other hand, unless the *additive noise* disturbance exceeds a certain threshold, the information contained in digital signals will remain intact. Their resistance to noise represents a key advantage of digital signals over analog signals.

Telecommunication networks.

A communications network is a collection of transmitters, receivers, and communications channels that send messages to one another. Some digital communications networks contain one or more routers that work together to transmit information to the correct user. An analog communications network consists of one or more switches that establish a connection between two or more users. For both types of network, repeaters may be necessary to amplify or recreate the signal when it is being transmitted over long distances. This is to combat attenuation that can render the signal indistinguishable from the noise.

Task II. Do the following statements agree with the information given in the text? Write TRUE, FALSE.

1. Communications signals are either by analog signals or digital signals.
2. The noise in a communication system can be expressed as adding or subtracting from the desirable signal in a completely simple way.
3. A communications network is a set of transmitters, receivers, and communications channels that receive messages to one another.
4. An analog communications network made up of one or more switches that establish a connection between two or more users.
5. The output of a transmitter is noise-free for all purposes.

Task III. Complete the text below using words from the box.

revenue modern product discuss society social impact

Telecommunication has a significant …… , cultural and economic …….. on……. society. In 2008, estimates placed the telecommunication industry's ……. at $3.85 trillion or just under 3 percent of the gross world……. (official exchange rate).Several following sections……..the impact of telecommunication on ……. .

LESSON 8

channel - a method or system for communication or distribution they didn't apply through the proper channels | some companies have a variety of sales channels 4) an electric circuit medium - a means by which something is communicated or expressed here the Welsh language is the medium of instruction

glass optical fiber thin glass fiber through which light can be transmitted

coaxial cable - a cable consisting of an inner insulated core of stranded or solid wire surrounded by an outer insulated flexible wire braid, used esp as a transmission line for radio-frequency which acts as a path for a signal

voltage- The voltage of an electrical current is its force measured in volts

current- a flow of electricity which results from the ordered directional movement of electrically charged particles

vacuum - a space entirely devoid of matter ■ a space or container from which the air has been completely or partly removed

frequency - the rate per second of a vibration constituting a wave, either in a material (as in sound waves), or in an electromagnetic field (as in radio waves and light)

adjacent - If one thing is adjacent to another, the two things are next to each other

allowance - the amount of something that is permitted, especially within a set of regulations or for a specified purpose

imperfection- a fault, blemish, or undesirable feature

Task I. Read the text and translate it.

COMMUNICATION CHANNELS

The term "channel" has two different meanings. In one meaning, a channel is the physical medium that carries a signal between the transmitter and the receiver. Examples of this include the atmosphere for sound communications, glass optical fibers for some kinds of optical communications, coaxial cables for communications by way of the voltages and electric currents in them, and free space for communications using visible light, infrared waves, ultraviolet light, and radio waves. This last channel is called the "free space channel". The sending of radio waves from one place to another has nothing to do with the presence or absence of an atmosphere between the two. Radio waves travel through a perfect vacuum just as easily as they travel through air, fog, clouds, or any other kind of gas besides air.

The other meaning of the term "channel" in telecommunications is seen in the phrase communications channel, which is a subdivision of a transmission medium so that it can be used to send multiple streams of information simultaneously. For example, one radio station can broadcast radio waves into free space at frequencies in the neighborhood of 94.5 MHz (megahertz) while another radio station can simultaneously broadcast radio waves at frequencies in the neighborhood of 96.1 MHz. Each radio station would transmit radio waves over a frequency bandwidth of about 180 kHz (kilohertz), centered at frequencies such as

the above, which are called the "carrier frequencies". Each station in this example is separated from its adjacent stations by 200 kHz, and the difference between 200 kHz and 180 kHz (20 kHz) is an engineering allowance for the imperfections in the communication system.

Task II. Answer the following questions.

1. What does the term channel mean?
2. How is the last channel called?
3. What is the other meaning of the term?
4. How do radio waves travel?
5. At what frequency would radio station transmit radio waves?

Task III. Complete the text below using words from the box.

important optical device can considered attract

A **beacon** is an intentionally conspicuous …….designed to…… attention to a specific location. Beacons ……. also be combined with semaphoric or other indicators to provide ……..information, such as the status of an airport, by the colour and rotational pattern of its airport beacon, or of pending weather as indicated on a weather beacon mounted at the top of a tall building or similar site. When used in such fashion, beacons can be …….. a form of …….. telegraphy.

Task IV. Match the words.

1.	discrete	a)	the regard that something is held to deserve
2.	value	b)	a fault, blemish, or undesirable feature
3.	reception	c)	the interruption of a settled and peaceful condition
4.	additive	d)	individually separate and distinct
5.	random	e)	the amount of something produced by a person
6.	disturbance	f)	characterized by, relating to,
7.	output	g)	sample or method i
8.	amplify	h)	be greater in number or size than
9.	exceed	i)	increase the volume
10.	imperfection	j)	the action or process of receiving something sent

UNIT II

EXTRA INFORMATION FOR HOME READING

Smoke signal

Native Americans on a painting by Frederic Remington

The **smoke signal** is one of the oldest forms of long-distance communication. It is a form of visual communication used over long distance.

History and usage

In Ancient China, soldiers stationed along the Great Wall would alert each other of impending enemy attack by signaling from tower to tower. In this way, they were able to transmit a message as far away as 750 kilometres (470 mi) in just a few hours.Polybius, a Greek historian, came up with a more complex system of alphabetical smoke signals around 150 BC. He invented a system of converting Greek alphabetic characters into numeric characters. It was devised to enable messages to be easily signaled by holding sets of torches in pairs. This idea, known as the "Polybius square", also lends itself to cryptography and steganography. This cryptographic concept has been used with Japanese Hiragana and the Germans in the later years of the First World War.The North American Indians also communicated via smoke signal. Each tribe had their own signaling system and understanding. A signaler started a fire on an elevation typically using damp grass, which would cause a column of smoke to rise. The grass would be taken off as it dried and another bundle would be placed on the fire. Reputedly the location of the smoke along the incline conveyed a meaning. If it came from halfway up the hill, this would signify all was well, but from the top of the hill it would signify danger.Smoke signals are still in use today. In Rome, the College of Cardinals uses smoke signals to indicate the selection of a new Pope. Eligible cardinals conduct a secret ballot until someone receives a vote of two-thirds plus one. The ballots are burned after each vote. Black smoke indicates a failed ballot; white smoke means a new Pope has been elected.In general smoke signals are used to transmit news, signal danger, or gather people to a common area.

Examples

Native Americans

Lewis and Clark's journals cite several occasions when they adopted the Native American method of setting the plains on fire to communicate the presence of their party or their desire to meet with local tribes.

Yámana

Yámanas used fire to send messages by smoke signals, for instance if a whale drifted ashore. The large amount of meat required notification of many people, so that it would not decay. They might also have used smoke signals on

other occasions, thus it is possible that Magellan saw such fires (which inspired him to name the landscape Tierra del Fuego) but he may have seen the smoke or lights of natural phenomena.

Noon Gun

Noon Gun time signalling was used to set marine chronometers in Table Bay.

Australian Aborigines

Australian Aborigines would send up smoke to notify others of their presence, particularly when entering lands which were not their own. However, these were not complex signals; smoke simply told others where one was located.

Semaphore line

A Chappe telegraph at Louvre, France

A **semaphore telegraph**, **optical telegraph**, **shutter telegraph chain**, **Chappe telegraph**, or **Napoleonic semaphore** is a system of conveying information by means of visual signals, using towers with pivoting shutters, also known as blades or paddles. Information is encoded by the position of the mechanical elements; it is read when the shutter is in a fixed position. These systems were popular in the late 18th to early 19th century. In modern usage, "semaphore line" and "optical telegraph" may refer to a relay system using flag semaphore, and "optical telegraph" may refer to a heliograph (optical telegraphy using mirror-directed sunlight reflections).

Semaphore lines were a precursor of the electrical telegraph. They were far faster than post riders for bringing a message over long distances, but far more expensive and less private than the electrical telegraph lines which would replace them. The distance that an optical telegraph can bridge is limited by geography and weather; thus, in practical use, most optical telegraphs used lines of relay stations to bridge longer distances.

History

Claude Chappe

Optical telegraphy dates from ancient times, in the form of hydraulic telegraphs, torches (as used by ancient cultures since the discovery of fire) and smoke signals.Modern design of semaphores was first foreseen by the English scientist Robert Hooke, who first gave a vivid and comprehensive outline of visual telegraphy to the Royal Society in a submission dated 1684 in which he outlined many practical details. The system (motivated by military concerns, following the recent Battle of Vienna in 1683) was never put into practice.

The first achieved optical telegraph arrived in 1792 from the French engineer Claude Chappe and his brothers, who succeeded in covering France with a network of 556 stations stretching a total distance of 4,800 kilometres. It was used for military and national communications until the 1850s.

Many national services adopted signaling systems different from the Chappe system. For example, Britain and Sweden adopted systems of shuttered panels (in contradiction to the Chappe brothers' contention that angled rods are more visible). In Spain, the engineer Agustín de Betancourt developed his own system which was adopted by that state. This system was considered by many experts in Europe better than Chappe's, even in France.

France

A Chappe semaphore tower near Saverne, France

There was a desperate need for swift and reliable communications in France during the period of 1790–1795. It was the height of the French revolution, and France was surrounded by the enemy forces of Britain, the Netherlands, Prussia, Austria, and Spain. The cities of Marseilles and Lyon were in revolt, and the British Fleet held Toulon. In this situation the only advantage France held was the lack of cooperation between the allied forces due to their inadequate lines of communications.

The Chappe brothers in the summer of 1790 set about devising a system of communication that would allow the central government to receive intelligence and to transmit orders in the shortest possible time. On March 2, 1791 at 11 A.M., Chappe and his brother sent the message “si vous réussissez, vous serez bientôt couverts de gloire” (If you succeed, you will soon bask in glory) between Brulon and Parce, a distance of ten miles (16 km). The first means used a combination of black and white panels, clocks, telescopes, and codebooks to send their message.

The Chappes carried out experiments during the next two years, and on two occasions their apparatus at Place de l'Étoile, Paris was destroyed by mobs who thought they were communicating with royalist forces. However in the summer of 1792 Claude was appointed *Ingénieur-Télégraphiste* and charged with establishing a line of stations between Paris and Lille, a distance of 230 kilometres (about 143 miles). It was used to carry dispatches for the war between France and Austria. In 1794, it brought news of a French capture of Condé-sur-l'Escaut from the Austrians less than an hour after it occurred. The first symbol of a message to Lille would pass through 15 stations in only nine minutes. The speed of the line varied with the weather, but the line to Lille typically transferred 36 symbols, a complete message, in about 32 minutes.

Paris to Strasbourg with 50 stations was the next line and others followed soon after. By 1824, the Chappe brothers were promoting the semaphore lines for commercial use, especially to transmit the costs of commodities. Napoleon Bonaparte saw the military advantage in being able to transmit information between locations, and carried a portable semaphore with his headquarters. This allowed him to coordinate forces and logistics over longer distances than any other army of his time. However because stations had to be within sight of each other,

and because the efficient operation of the network required well trained and disciplined operators, the costs of administration and wages were a continuous source of financial difficulties. Only when the system was funded by the proceeds of its own lottery did costs come under control.

In 1821 Norwich Duff, a young British Naval officer, visiting Clermont-en-Argonne, walked up to the telegraph station there and engaged the signalman in conversation. Here is his note of the man's information:

The pay is twenty five *sous* per day and he [the signalman] is obliged to be there from day light till dark, at present from half past three till half past eight; there are only two of them and for every minute a signal is left without being answered they pay five *sous*: this is a part of the branch which communicates with Strasburg and a message arrives there from Paris in six minutes it is here in four.

Description

The Chappe brothers determined by experiment that it was easier to see the angle of a rod than to see the presence or absence of a panel. Their semaphore was composed of black movable wooden arms, the position of which indicated alphabetic letters. With counterweights (named *forks*) on the arms, the Chappe system was controlled by only two handles and was mechanically simple and reasonably robust. Each of the two 2-metre-long arms showed seven positions, and the 4.6-metre-long cross bar connecting the two arms had four different angles, for a total of 196 symbols (7x7x4). Night operation with lamps on the arms was unsuccessful.

To speed up transmission and to provide some semblance of security a code book was developed for use with semaphore lines. The Chappes' corporation used a code that took 92 of the basic symbols two at a time to yield 8,464 coded words and phrases.

From 1803 on, the French also used the 3-arm Depillon semaphore at coastal locations to provide warning of British incursions.

Sweden

Replica of Swedish optical telegraph tower.

At the same time as Chappe, the Swedish inventor Abraham Niclas Edelcrantz experimented with the optical telegraph in Sweden. In 1794 he inaugurated his telegraph with a poem dedicated to the Swedish King on his birthday. The message went from the Palace in Stockholm to the King at Drottningholm.

Edelcrantz eventually developed his own system which was quite different from its French counterpart and nearly twice as fast. The system was based on ten collapsible iron shutters. The various positions of the shutters formed combinations of numbers which were translated into letters, words or phrases via codebooks. The telegraph network consisted of telegraph stations positioned at about 10 kilometres from one another.

Soon telegraph circuits linking castles and fortresses in the neighbourhood of Stockholm were set up and the system was extended to Grisslehamn and Åland. Subsequently telegraph circuits were introduced between Gothenburg and

Marstrand, at Helsingborg and between Karlskrona and its fortresses. Sweden was the second country in the world, after France, to introduce an optical telegraph network. The Swedish optical telegraph network was restricted to the archipelagoes of Stockholm, Gothenburg and Karlskrona. Like its French counterpart, it was mainly used for military purposes.

U.K.

Lord George Murray, stimulated by reports of the Chappe semaphore, proposed a system of visual telegraphy to the British Admiralty in 1795. He employed rectangular framework towers with six large octagonal shutters on horizontal axes that flipped between horizontal and vertical positions to signal . The Rev. Mr Gamble also proposed two distinct five element systems in 1795: one using five shutters, and one using five ten foot poles. The British Admiralty accepted Murray's system in September 1795, and the first system was the 15 site chain from London to Deal. Messages passed from London to Deal in about sixty seconds, and sixty-five sites were in use by 1808. Each shutter was five feet high. In 1816, Murray's shutter telegraphs were replaced by simpler semaphores invented by Sir Home Popham.A Popham semaphore was a single fixed vertical 30 foot pole, with two movable 8 foot arms attached to the pole by horizontal pivots at their ends, one arm at the top of the pole, and the other arm at the middle of the pole. The signals of the Popham semaphore were found to be much more visible than those of the Murray semaphore. Popham's 2-arm semaphore was modeled after the 3-arm Depillon French semaphore.

Chains of Murray's shutter telegraph stations were built along these routes:

Diagram of U.K. Murray six-shutter system, with shutter 6 in the horizontal position, and shutters 1-5 vertical

Liverpool – Holyhead

Liverpool, Bidston, Hilbre Island, Voel Nant, Foryd, Llysfaen, Puffin Island, Point Lynas, Carreglwyd, Cefn Du, Holyhead

London - Deal and Sheerness

Admiralty (London), West Square Southwark, New Cross, Shooter's Hill, Swanscombe, Gad's Hill, Callum Hill, Beacon Hill (Faversham, branch point), Shottenden, Barham Downs, Betteshanger, Deal.

(branch) Beacon Hill (Faversham), Tonge, Barrow Hill, Sheerness.

London - Great Yarmouth

St Albans High Street in 1807, showing the shutter telegraph on top of the city's Clock Tower.

Admiralty (London), Hampstead Heath (Telegraph Hill), Woodcock Hill, St Albans, Dunstable Downs, Lilley Hoo, Baldock, Royston, Gog Magog Hills, Newmarket (Side Hill), Icklingham, Barnham, East Harling, Carleton Rode, Wreningham, Norwich, Strumpshaw, Great Yarmouth.

London - Portsmouth and Plymouth

Admiralty (London), Chelsea Royal Hospital, Putney Heath, Cabbage Hill, Netley Heath, Hascombe, Blackdown, Beacon Hill (branch point), Portsdown Hill, Portsmouth (Southsea Common).

(branch) Beacon Hill, Chalton, Wickham, Town Hill, Toot Hill, Bramshaw, Pistle Down, Chalbury, Blandford racecourse, Belchalwell, Nettlecombe Tout, High Stoy, Toller Down, Lamberts Castle, Dalwood Common, St Cyrus, Rockbeare, Gt Haldon, South Knighton, Marley, Lee, Saltram, Plymouth.

The shutter stations were temporary wooden huts, and at the conclusion of the Napoleonic wars they were no longer necessary. In 1816 they were replaced by a simpler semaphore system. However the Admiralty decided to establish a permanent link to Portsmouth and built a chain of semaphore stations. These were operational from 1822 until 1847, when the railway and electric telegraph provided a better means of communication. The semaphore did not use the same locations as the shutter chain, but followed almost the same route with 15 stations -Admiralty (London), Chelsea Royal Hospital, Putney Heath, Coombe Warren, Coopers Hill, Chatley Heath, Pewley Hill, Bannicle Hill, Haste Hill (Haslemere), Holder Hill, (Midhurst), Beacon Hill, Compton Down, Camp Down, Lumps Fort (Southsea) and Portsmouth Dockyard. The semaphore tower at Chatley Heath, which replaced the Netley Heath station of the shutter telegraph, has been restored by Surrey County Council and is open to the public.

A semaphore-based successor for the London to Plymouth shutter telegraph chain, branching much closer to London, at Chatley Heath in Surrey, was started but abandoned before completion.Many of the prominences on which the towers were built are known as 'Telegraph Hill' to this day. As in France the network required lavish amounts of money and manpower to operate and could only be justified as a defence need.

Optical telegraph of Claude Chappe on the Litermont near Nalbach, Germany.

Optical telegraph in the harbour of Bremerhaven, Germany.

Once it had proved its success, the optical telegraph was imitated in many other countries, especially after it was used by Napoleon to coordinate his empire and army. In most of these countries, the postal authorities operated the semaphore lines.

In Canada, Prince Edward, Duke of Kent established the first semaphore line in North America. In operation by 1800, it ran between the city of Halifax and the town of Annapolis in Nova Scotia, and across the Bay of Fundy to Saint John and Fredericton in New Brunswick. In addition to providing information on approaching ships, the Duke used the system to relay military commands, especially as they related to troop discipline. The Duke had envisioned the line reaching as far as the British garrison at Quebec City. However, the many hills and coastal fog meant the towers needed to be placed relatively close together to ensure visibility. The required labour to build and continually man so many stations taxed the already stretched-thin British military and there is doubt the New Brunswick line was ever in operation. With the exception of the towers around Halifax harbour, the system was abandoned shortly after the Duke's departure in August 1800.

In 1801, the Danish post office installed a semaphore line across the Great Belt strait, *Storebæltstelegrafen*, between islands Funen and Zealand with stations at Nyborg on Funen, on the small island Sprogø in the middle of the strait, and at Korsør on Zealand. It was in use until 1865.

The Kingdom of Prussia began with a line 750 kilometres long between Berlin and Coblenz in 1833, and in Russia, Tsar Nicolas I inaugurated the line between Moscow and Warsaw (1200 km) in 1833; this needed 220 stations manned by 1320 operators.

In the United States the first optical telegraph was built by Jonathan Grout. It was a 104-kilometre line connecting Martha's Vineyard with Boston, and its purpose was to transmit news about shipping. One of the principal hills in San Francisco, California is also named "Telegraph Hill", after the semaphore telegraph which was established there in 1849 to signal the arrival of ships into San Francisco Bay.

The semaphores were successful enough that Samuel Morse failed to sell the electrical telegraph to the French government. However, France finally committed to replace semaphores with electric telegraphs in 1846. Note that electric telegraphs are both more private and almost completely unaffected by weather; they also work at night. Many contemporaries predicted the failure of electric telegraphs because "they are so easy to cut." The last stationary semaphore link in regular service was in Sweden, connecting an island with a mainland telegraph line. It went out of service in 1880.

In Ireland, Richard Lovell Edgeworth (1744–1817) proposed a telegraph there when a French invasion was anticipated in 1794, and again in 1796; however, the proposal was not implemented. Soon, the British forces fighting Napoleon in Portugal found that the Portuguese army had a very capable semaphore system giving the Duke of Wellington a decisive advantage in intelligence.

Flag signals can mean any of various methods of using flags or pennants to send signals. Flags may have individual significance as signals, or two or more flags may be manipulated so that their relative positions convey symbols. Flag signals allowed communication at a distance before the invention of radio and are still used especially in connection with ships.

Flaghoist signalling

Gale warning

Flaghoist signalling is one or more flags (or pennants) simultaneously flying from a fixed halyard, and generally any method of signaling by such means. Each of the flags has a distinct shape and color combination. Each flag or combination of flags has a preassigned meaning or "code". The International Code of Signals defines a standard set of flags and associated alphabet suitable for international use, as well as a set of standard codes. Flaghoist is also used in boat racing, to warn of impending severe weather, and other specialized applications.

Maritime flag signalling has a long history, especially prior to the advent of radio, and remains the preferred means of signaling in many situations. In naval flag signalling, additional flags and an expanded list of signals are used for identification and commands, as well as the mercantile uses. Many navies have

their own proprietary or secret codes, and use additional flags. A designator flag is used to indicate if a flaghoist signal is meant to be interpreted as an ICS signal or as a naval signal. The U.S. Navy uses a set of 68 flags, including flags for each letter of the alphabet and each numeral to convey messages of tactical or administrative nature.

SemaphoreFlag semaphore signalling uses two flags, held in specific positions to signify letters. This method requires simple equipment but can be obscured by bad weather. A permanently installed chain of semaphore stations is a semaphore line and before the invention of the electric telegraph, was the fastest means of communication over moderately long distances.

Wig-wag flags

A typical US Signal Corps Guidon features wig-wag flags.

In the 1850s, U.S. Army Major Albert J. Myer, a surgeon by training, developed a system using left or right movements of a flag (or torch or lantern at night). Myer's system used a single flag, waved back and forth in a binary code conceptually similar to the Morse code of dots and dashes. This is sometimes called the *wig-wag* method of signaling, or "wig-wagging". More mobile than previous means of optical telegraphy, as it only required one flag and a 6–8 feet platform on which to stand the signal corpsman, this code was used extensively by Signal Corps troops on both sides in the American Civil War. (Its first use in battle was by Confederate Lieutenant Edward Porter Alexander at the First Battle of Bull Run in 1861.)

In this code, alphabet letters were equated with three positions of a single flag, disk, or light. The flags measured two, four, or six feet (60, 120 or 180 cm) square and were generally either red, orange or black banners with white square centers or white banners with red or orange square centers. The disks were 12 to 18 inches (30 to 46 cm) in diameter and were made of metal or wood frames with canvas surfaces. Somewhat easier to handle than the flags, they provided a different method for daylight communications. The lights were kerosene lanterns attached to a staff. A second "foot torch" was placed on the ground before the signalman as a fixed point of reference, making it easier for the recipient to follow the lantern's movements.

Each letter consisted of a combination of three basic motions. All began with the flagman holding his device vertically and motionless above his head. The first motion was initiated by bringing the device downward on the signalman's right side and then quickly returning it to its upright position. The second motion brought the device down on the left side and then returned it to the starting position. The third motion lowered the device in front of the signalman, then restored it to its vertical position.

Electrical telegraph

A printing **electrical telegraph receiver**, and a **transmitter key** at bottom right.An **electrical telegraph** is a telegraph that uses electrical signals, usually conveyed via telecommunication lines or radio. The *electromagnetic telegraph* is a device for human-to-human transmission of coded text messages.The electrical telegraph, or more commonly just *'telegraph'*, superseded optical semaphore

telegraph systems, such as those designed by Claude Chappe for the French military, and Friedrich Clemens Gerke for the Prussian military, thus becoming the first form of electrical telecommunications. In a matter of decades after their creation, electrical telegraph networks permitted people and commerce to almost instantly transmit messages across both continents and oceans, with widespread social and economic impacts.

History

Early works and messages

'Early Telegraph' **historical marker** outside Elizabethtown, Pennsylvania. From early studies of electricity, electrical phenomena were known to travel with great speed, and many experimenters worked on the application of electricity to communications at a distance. All the known effects of electricity - such as sparks, electrostatic attraction, chemical changes, electric shocks, and later electromagnetism - were applied to the problems of detecting controlled transmissions of electricity at various distances. In 1746 the French scientist and abbé Jean-Antoine Nollet, gathered about two hundred monks into a circle about a mile (1.6 km) in circumference, with pieces of iron wire connecting them. He then discharged a battery of Leyden jars through the human chain and observed that each man reacted at substantially the same time to the electric shock, showing that the speed of electricity's propagation was very high.In 1753 an anonymous writer in the *Scots Magazine* suggested an electrostatic telegraph. Using one wire for each letter of the alphabet, a message could be transmitted by connecting the wire terminals in turn to an electrostatic machine, and observing the deflection of pith balls at the far end. Telegraphs employing electrostatic attraction were the basis of early experiments in electrical telegraphy in Europe, but were abandoned as being impractical and were never developed into a useful communication system.In 1800 Alessandro Volta invented the Voltaic Pile, allowing for a continuous current of electricity for experimentation. This became a source of a low-voltage current that could be used to produce more distinct effects, and which was far less limited than the momentary discharge of an electrostatic machine, which with Leyden jars were the only previously known man-made sources of electricity.Another very early experiment in electrical telegraphy was an **electrochemical telegraph** created by the German physician, anatomist and inventor Samuel Thomas von Sömmering in 1809, based on an earlier, less robust design of 1804 by Catalan polymath and scientist Francisco Salva Campillo. Both their designs employed multiple wires (up to 35) to represent almost all Latin letters and numerals. Thus, messages could be conveyed electrically up to a few kilometers (in von Sömmering's design), with each of the telegraph receiver's wires immersed in a separate glass tube of acid. An electric current was sequentially applied by the sender through the various wires representing each digit of a message; at the recipient's end the currents electrolysed the acid in the tubes in sequence, releasing streams of hydrogen bubbles next to each associated letter or numeral. The telegraph receiver's operator would watch the bubbles and could then record the transmitted message, albeit at a very low baud rate. The principal disadvantage to the system was its prohibitive cost, due to

having to manufacture and string-up the multiple wire circuits it employed, as opposed to the single wire (with ground return) used by later telegraphs.

In 1816, Francis Ronalds set up a primitive telegraph. He ran eight miles (13 km) of cable (encased in glass tubing) through his back garden suspending it from two wooden lattices. and succeeded in getting an electrical signal along the full length using static high voltage electricity. At both ends there were clockwork operated dials with numbers and letters of the alphabet.

Hans Christian Ørsted discovered in 1820 that an electric current produces a magnetic field which will deflect a compass needle. In the same year Johann Schweigger invented the galvanometer, with a coil of wire around a compass, which could be used as a sensitive indicator for an electric current.

In 1821, André-Marie Ampère suggested that telegraphy could be done by a system of galvanometers, with one wire per galvanometer to indicate each letter, and said he had experimented successfully with such a system. In 1824, Peter Barlow said that such a system only worked to a distance of about 200 feet (61 m), and so was impractical.

In 1825 William Sturgeon invented the electromagnet, with a single winding of uninsulated wire on a piece of varnished iron, which increased the magnetic force produced by electric current. Joseph Henry improved it in 1828 by placing several windings of insulated wire around the bar, creating a much more powerful electromagnet which could operate a telegraph through the high resistance of long telegraph wires. In 1832 an electromagnetic telegraph was created by Baron Schilling in Russia, and in 1833 Carl Friedrich Gauss and Wilhelm Weber invented their own code to communicate over a distance of 1200 m within Göttingen, Germany.

Then in 1835 Joseph Henry invented the critical electrical relay, by which a weak current could operate a powerful local electromagnet over very long distances.

Schilling telegraph

The telegraph invented by Baron Schilling von Canstatt in 1832 had a transmitting device which consisted of a keyboard with 16 black-and-white keys. These served for switching the electric current. The receiving instrument consisted of six galvanometers with magnetic needles, suspended from the silk threads. Both stations of Shilling's telegraph were connected by eight wires; six were connected with the galvanometers, one served for the return current and one - for a signal bell. When at the starting station the operator pressed a key, the corresponding pointer was deflected at the receiving station. Different positions of black and white flags on different disks gave combinations which corresponded to the letters or numbers. Pavel Shilling subsequently improved its apparatus. He reduced the number of connecting wires from eight to two.

On October 21, 1832, Schilling managed a short-distance transmission of signals between two telegraphs in different rooms of his apartment. In 1836 the British government attempted to buy the design but Schilling instead accepted overtures from Nicholas I of Russia. Schilling's telegraph was tested on a 5 kilometres (3.1 mi) experimental underground and underwater cable, laid around

the building of the main Admiralty in Saint Petersburg and was approved for a telegraph between the imperial palace at Peterhof and the naval base at Kronstadt. However, the project was cancelled following Schilling's death in 1837.[8] Schilling was also one of the first to put into practice the idea of the binary system of signal transmission.

William Fothergill Cooke studied anatomy in Heidelberg in 1834-6, where the physics professor introduced him to the Schilling telegraph in 1836.

Gauss-Weber telegraph and Carl Steinheil

Carl Friedrich Gauss, one of the most influential mathematicians of the early 19th century, developed a new theory of the Earth's magnetism in 1831, together with the physics professor Wilhelm Weber in Göttingen. Among the most important inventions of the time was the unifilar and bifilar magnetometer, enabling them to measure even the smallest deflections of the needle. In 1833 they installed a 1,200 metres (3,900 ft) long wire above the town's roofs. Gauss combined the Poggendorff-Schweigger multiplicator with his magnetometer to build a more sensitive device, the galvanometer. To change the direction of the electric current, he constructed a commutator of his own. As a result, he was able to make the distant needle move in the direction set by the commutator on the other end of the line.

At first, they used the telegraph to coordinate time, but soon they developed other signals; finally, their own alphabet. The alphabet was encoded in a binary code which was transmitted by positive or negative voltage pulses which were generated by means of moving an induction coil up and down over a permanent magnet and connecting the coil with the transmission wires by means of the commutator. The page of Gauss' laboratory notebook containing both his code and the first message transmitted, as well as a replica of the telegraph made in the 1850s under the instructions of Weber are kept in the faculty of physics of Göttingen University.

Gauss was convinced that this communication would be a help to his kingdom's towns.

Later in the same year, instead of a Voltaic pile, Gauss used an induction pulse, enabling him to transmit seven letters a minute instead of two. The inventors and university were too poor to develop the telegraph on their own, but they received funding from Alexander von Humboldt. Carl August Steinheil in Munich was able to build a telegraph network within the city in 1835-6. He installed a telegraph line along the first German railroad in 1835.

Alter and the Elderton Telegraph

Across the Atlantic, in 1836 an American scientist, Dr. David Alter, invented the first known American electric telegraph, in Elderton, Pennsylvania, one year before the Morse telegraph. Alter demonstrated it to witnesses but never developed the idea into a practical system. He was interviewed later for the book Biographical and Historical Cyclopedia of Indiana and Armstrong Counties, in which he said: "I may say that there is no connection at all between the telegraph

of Morse and others and that of myself.... Professor Morse most probably never heard of me or my Elderton telegraph."

Cooke & Wheatstone The first commercial electrical telegraph was co-developed by Sir William Fothergill Cooke and Cha**rles Wheatstone. Cooke and Wheatstone patented it in May 1837 as an alarm system, and it was first successfully demonstrated on 25 July 1837 between Euston and Camden Town in London. It entered commercial use on the Great Western Railway over the 13 miles (21 km) from Paddington station to West Drayton on 9 April 1839. John Tawell was apprehended following the use of a needle telegraph message from Slough to Paddington on 1 January 1845. This is thought to be the first use of the telegraph to catch a murderer. The message was:**

A MURDER HAS GUST BEEN COMMITTED AT SALT HILL AND THE SUSPECTED MURDERER WAS SEEN TO TAKE A FIRST CLASS TICKET TO LONDON BY THE TRAIN WHICH LEFT SLOUGH AT 742 PM HE IS IN THE GARB OF A KWAKER WITH A GREAT COAT ON WHICH REACHES NEARLY DOWN TO HIS FEET HE IS IN THE LAST COMPARTMENT OF THE SECOND CLASS COMPARTMENT

The Cooke-Wheatstone system did not support punctuation, lower case, or the letters J, Q, and Z; hence the misspelling of 'just' and 'Quaker'. "Second class compartment" should also probably read "second first-class carriage"; this information was not significant, however, as Tawell was not arrested at the station, but at a nearby coffee shop.

Morse telegraphs

In the United States, the telegraph was developed by Samuel Morse and Alfred Vail. Samuel F. B. Morse independently developed an electrical telegraph in 1836, an alternative design that was capable of transmitting over long distances using poor quality wire. His assistant, Alfred Vail, developed the Morse code signaling alphabet with Morse.

On 6 January 1838 Morse first successfully tested the device at the Speedwell Ironworks near Morristown, New Jersey, and on 8 February he publicly demonstrated it to a scientific committee at the Franklin Institute in Philadelphia, Pennsylvania.

In 1843 the U.S. Congress appropriated $30,000 to fund an experimental telegraph line from Washington, D.C. to Baltimore. By 1 May 1844, the line had been completed from the U.S. Capitol to Annapolis Junction in Maryland. That day the Whig Party nominated Henry Clay at its national convention in Baltimore. News of the nomination was hand-carried by railroad to Annapolis Junction where Vail wired it to Morse in the Capitol. On 24 May 1844, after the line was completed, Morse made the first public demonstration of his telegraph by sending a message from the Supreme Court Chamber in the U.S. Capitol in Washington, D.C. to the B&O Railroad "outer depot" (now the B&O Railroad Museum) in Baltimore. The

famous message was: *What hath God wrought* (from the Biblical Book of Numbers 23:23: *Surely there is no enchantment against Jacob, neither is there any divination against Israel: according to this time it shall be said of Jacob and of Israel, What hath God wrought!*).

The Americas' first telegram, transmitted via a repeater: "*What hath God wrought*", sent by Samuel F.B. Morse in 1844

The Morse-Vail telegraph was quickly deployed in the following two decades. Morse failed to properly credit Vail for the powerful electromagnets used in his telegraph. The original Morse design, without the relay or the "intensity" and "quantity" electromagnets invented by Vail, only worked to a distance of 40 feet (12 m).

This was a practical electrical telegraph system, and subsequently *electrical telegraph* came to refer to a signaling telegram - a system where an operator makes and breaks an electrical contact with a telegraph key, which results in an audible signal at the other end produced by a telegraph sounder, which is interpreted and transcribed by a human. Morse and Vail's first telegraphs used a pen and paper system to record the marks of the Morse Code, and interpreted the marks visually, but operators soon realized that they could "read" the clicking of the receiver directly by ear. Systems which automatically read the signals and print formed characters are generally called teleprinters rather than telegraph systems. Some electrical telegraphs used indicators which were read visually rather than by ear. The most notable of these was the early transatlantic telegraph cable.

According to a Pennsylvania Historical and Museum Commission heritage marker installed along Pennsylvania Route 230 near Elizabethtown, Pennsylvania in 1947 (see image at right), the first commercial telegraph line in the United States ran along a railroad right-of-way (currently part of Amtrak's Keystone Corridor) between Lancaster, Pennsylvania and Harrisburg, Pennsylvania in 1845. The first message, received on January 8, 1846, was "Why don't you write, you rascals?"

On 24 October 1861, the first transcontinental telegraph system was established. Spanning North America, an existing network in the eastern United States was connected to the small network in California by a link between Omaha and Carson City via Salt Lake City. The first telegram on that line was sent by Brigham Young, then governor of Utah which affirmed that the Territory had not seceded. It read "Utah has not seceded but is firm for the Constitution and the laws of our once happy country." The slower Pony Express system ceased operation two days later. Carson City has another claim in the history of telegraphs for the largest and costliest transmission ever sent came from there.

As the transcontinental telegraph was laid it passed through Nebraska where Republican sympathizers prior to the American Civil War were eager to gain statehood for Nevada before the next presidential election so that Abraham Lincoln

would have enough votes to win. They rushed to send the entire state constitution by telegraph to the United States Congress, which approved it and sent it to the President for signature. They did not believe sending it by train would guarantee it would arrive on time. The constitution was sent on 31 October, just eight days before the election on 7 November 1864.