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МЕТОДИЧНІ ВКАЗІВКИ

та навчальні завдання
з розвитку англомовного професійного спілкування
до практичних занять і самостійної роботи
для здобувачів вищої освіти першого (бакалаврського)
рівня за освітньо-професійною програмою
«Електроенергетика, електротехніка та електромеханіка»
спеціальності 141 «Електроенергетика, електротехніка та
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Методичні вказівки та навчальні завдання з розвитку англомовного професійного спілкування до практичних занять і самостійної роботи для здобувачів вищої освіти першого (бакалаврського) рівня за освітньо-професійною програмою «Електроенергетика, електротехніка та електромеханіка» спеціальності 141 «Електроенергетика, електротехніка та електромеханіка» денної та заочної форм навчання [Електронне видання] / Озарчук І. В., Осіпчук Н. В. – Рівне : НУВГП, 2024. – 52 с.

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Передмова

Методичні вказівки та навчальні завдання з розвитку англомовного професійного спілкування для практичних занять і самостійної роботи для здобувачів першого бакалаврського рівня вищої освіти ОПП «Електроенергетика, електротехніка та електромеханіка» укладено відповідно до програмних компетентностей та результатів навчання даних ОПП щодо здійснення усної та письмової комунікації іноземною мовою.

Мета укладених вказівок – розвиток навичок розуміння й аналізу оригінальних технічних текстів, збагачення словникового запасу новою лексикою, удосконалення навичок розмовної мови, уміння вести бесіду, брати участь у дискусіях англійською мовою, формувати соціально-комунікативну позицію фахівця з питань, пов'язаних з майбутньою професією.

Методичні вказівки містять сім тематичних розділів, кожен розділ містить окрему тему електротехніки та містить статті з фахової літератури. Тексти містять лексико-граматичні вправи та завдання, спрямовані на розвиток мовленнєвих навичок і вмінь використовувати лексичний матеріал у реальних ситуаціях спілкування.

Матеріали посібника дають уявлення про специфіку професійної діяльності майбутнього електрика контрольно-вимірювальних приладів, розширюють знання, отримані студентами при вивченні фахових предметів. Дана методична розробка спрямована на практичне вивчення мовних структур і лексики, необхідних для ефективної комунікації в академічному та професійному середовищі, зокрема під час практичних занять і самостійної роботи.

Зміст

Unit 1. The basic nature of electricity

Basic Vocabulary

electricity	electric charge
electron	positive / negative charge
atom	DC/AC
current	circuit
voltage	open / closed circuit
resistance	charge
conductor	ampere
insulator	mass
nucleus	matter
proton	volt / watt
neutron	Ohm's low
orbit	force

I. Match Ukrainian equivalents with English technical terms.

1. practical electricity	електричний опір
2. atomic particles	сила тяжіння
3. electric current	зовнішня сила
4. electric charge	розімкнуте коло
5. electric circuit	замкнуте коло
6. electrical structure	опір струму
7. electrical properties	потік струму
8. positive and negative particles	орбіта електрона
9. electric potential	атомне ядро
10. electrical resistance	ядерна структура
11. energy transfer	рух електронів
12. voltage source	практична електрика
13. conductor material	атомні частинки
14. insulating material	електричний струм
15. electron movement	електричний заряд
16. nuclear structure	джерело напруги
17. atomic nucleus	позитивні та негативні частини
18. electron orbit	електричне коло
19. current flow	електричний потенціал
20. opposition to current	провідниковий матеріал
21. closed circuit	електрична структура

22. open circuit	ізоляційний матеріал
23. external force	передача енергії
24. force of attraction	електричні властивості

II. Match the words on the left with their corresponding definitions on the right.

1. Electron	A. The flow of electric charge through a conductor.
2. Atom	B. A material that allows electricity to pass through easily.
3. Current	C. The central part of an atom, containing protons and neutrons.
4. Voltage	D. The pressure that drives electric charges to move in a circuit.
5. Resistance	E. A small negatively charged particle that orbits the nucleus of an atom.
6. Conductor	F. The opposition to the flow of electric current in a material.
7. Insulator	G. A positively charged particle found in the nucleus of an atom.
8. Circuit	H. The smallest unit of matter, consisting of a nucleus and electrons.
9. Proton	I. A complete path that allows electric current to flow.
10. Nucleus	J. A material that does not easily allow electricity to pass through.

III. Read and translate the text.

The Nature of Electricity

Electricity is a fundamental force in nature, produced by the movement of tiny particles called electrons. These electrons are part of atoms, the basic building blocks of matter. When electrons move, they create energy, which we observe as heat, light, and other effects. The study of electricity involves understanding how these electrons move, the pressure or voltage that drives them, and the resistance they face in different materials.

The atomic theory tells us that all matter, everything that occupies

space and has mass, is made up of particles with electrical properties. These particles can be positive or negative, and their balance determines the electrical state of an object. For instance, when electrons move through a material like a wire, an electric current is generated. However, not all materials conduct electricity equally well-some, like metals, allow electrons to flow easily, while others, like rubber, resist the flow of electricity.

Understanding electricity requires a grasp of the structure of matter. Matter includes any physical substance, such as wood, water, or iron, that takes up space and has mass. Energy, while closely related to matter, is different. It has no mass and does not occupy space. Heat and light are forms of energy produced by the movement of electrons.

The smallest unit of matter is the atom, which consists of a central nucleus surrounded by electrons. These electrons are negative particles that move around the nucleus in specific orbits, similar to how planets revolve around the sun. The movement of these electrons, especially when they are influenced by an external force like voltage, is what produces electricity.

(*Taken from:* https://www.tutorialspoint.com/what-is-the-nature-of-electricity)

IV. Answer the following questions based on the text.

1. What produces practical electricity?
2. What happens when electrons move?
3. What is the relationship between voltage and the movement of electrons?
4. What does the atomic theory state about all matter?
5. What is the difference between a conductor and an insulator?
6. What are the basic components of an atom?
7. How do electrons move around the nucleus of an atom?
8. What is the role of resistance in an electrical circuit?
9. Why is energy different from matter?
10. What happens in an open circuit compared to a closed circuit?

V. Complete the sentences with the correct verb from the list above. Translate the sentences into Ukrainian.

Produce, move, flow, generate, conduct, resist, orbit, attract, repel, force, oppose, control.

1. Electrons _____ around the nucleus of an atom in specific paths.
2. Materials like copper _____ electricity very well due to their low resistance.
3. Insulators _____ the flow of electric current, preventing it from passing through.
4. Voltage _____ the movement of electrons through a circuit.
5. The electric current _____ through the wire when the circuit is closed.
6. Opposite charges _____ each other, while like charges repel.
7. Resistance _____ the flow of electric current in a material.
8. The movement of electrons _____ electricity, which we use in our homes.
9. A generator _____ electricity by converting mechanical energy into electrical energy.
10. The electrons _____ from the negative terminal to the positive terminal in a circuit.
11. Electric fields can _____ particles with the same charge.
12. A switch _____ the flow of current in an electrical circuit.

VI. Finish the sentences using field-related vocabulary.

1. Electric energy plays a crucial role in ...
2. A significant amount of electricity is used for ...
3. Advances in electrical engineering have led to ...
4. Electrical faults can occur due to ...
5. Electrical engineers need to be proficient in ...
6. Proper insulation is essential to prevent ...
7. Modern industries rely heavily on ...
8. The efficiency of electrical systems depends on ...

VII. Translate the words in brackets.

1. The (електрон) is a fundamental particle with a negative charge.
2. Electrical (струм) is the flow of electric charge through a conductor.

3. The (опір) in a circuit opposes the flow of electric current.

4. In an open (ланцюг), the current cannot flow due to a break in the path.

5. (Напруга) is the electrical potential difference between two points.

6. An electric (ланцюг) consists of a power source, conductors, and a load.

7. The (енергія) required to move a charge is called electrical energy.

8. A (конденсатор) stores electrical energy in an electric field.

9. The unit of electrical (опір) is the ohm.

10. (Провідник) allows electricity to flow through it easily.

VIII. Make the sentences using the words.

Improve, resist, increase, exist, reduce, semiconductor, illumination, efficiency, variability, conduct, fundamental, technological.

IX. Choose the right option.

1. Electricity is a phenomenon associated with stationary or moving electric ... .

a*) charges* *b) atoms* *c) conductors*

2. The Greeks discovered that ... rubbed with fur attracted light objects.

a) gold *b) rubber* *c) amber*

3. The invention of the ... and the construction of the first central power station led to the rapid introduction of electric power into factories and homes.

a) semiconductors *b) incandescent light bulb*

c) the number of electrons

4. Most elementary particles of matter possess charge, either ... or negative.

a) chemical *b) positive* *c) moving*

5. If the numbers of ... and protons are equal, the atom is electrically neutral.

a) electrons *b) atoms* *c) charges*

6. According to the ability of the materials to allow charge to flow

through them, there are …types of them.

a) two *b) ten* *c) three*

X. Writing

Write a short essay (150-200 words) about the basic nature of electricity. Use the following points to help you structure your essay.

1. What is electricity? Explain in simple terms.
2. How does electricity work? Describe how it flows through circuits.
3. Why is electricity important? Mention a few everyday uses.

Unit 2. Electrical measuring instruments and their implementation.

Basic Vocabulary

multimeter	parallel
ammeter	measurement
voltmeter	accuracy
wattmeter	safety
ohmmeter	frequency
oscilloscope	waveform
power	signal
series	range

I. Match Ukrainian equivalents with English technical terms

1. digital multimeter	діапазон безпеки
2. series circuit	послідовний ланцюг
3. voltage measurement	паралельне з’єднання
4. resistance accuracy	вимірювання частоти
5. current signal	дисплей осцилографа
6. safety range	цифровий мультиметр
7. analog ammeter	аналоговий амперметр
8. power circuit	силовий ланцюг
9. waveform analysis	аналіз форми сигналу
10. frequency measurement	точність опору
11. oscilloscope display	сигнал струму
12. parallel connection	вимірювання напруги

II. Read and translate the text.

Electrical measuring instruments are essential tools for monitoring, measuring, and analysing electrical circuits and systems. These instruments are vital for maintaining safety, accuracy, and efficiency in various industries, including construction, manufacturing, and electrical engineering. In this article, we'll explore different electrical instruments, such as:

1. Multimeter
2. Ammeter
3. Voltmeter
4. Wattmeter
5. Ohmmeter
6. Oscilloscope

We'll dive into their applications and provide guidance on how to use them correctly to obtain precise measurements.

Multimeter

The multimeter is one of the most versatile electrical measuring instruments, commonly used in laboratories. It can measure multiple electrical quantities, including voltage, current, and resistance, making it invaluable for troubleshooting and maintaining electrical systems.

Ammeter

An ammeter measures the direct or alternating current in a circuit, with current measured in amperes (A). Ammeters are connected in series with the circuit and have very low resistance, allowing a large amount of current to flow through. They can measure a wide range of current values, with specialized versions like microammeters or milliammeters used for smaller currents. There are two main types of ammeters: analog, which uses a pointer and dial, and digital, which uses a digital display.

Voltmeter

Voltmeters measure the electrical potential difference, or voltage, between two points in a circuit, with voltage measured in volts. They are connected in parallel with the component or circuit being measured and have high resistance to minimize current flow through the meter.

Wattmeter

Wattmeters measure power, or the rate at which energy is used, in

a circuit, with power measured in watts (W). They are typically used in three-phase systems to measure both apparent and real power. Wattmeters are essential for inspecting power supply and determining energy costs. They calculate power using the formula P = VI, where P is power, V is voltage, and I is current.

Ohmmeter

An ohmmeter measures electrical resistance, with readings provided in ohms (Ω). It is connected in series with the circuit being tested and is used to check continuity, identify circuit breaks, or measure component resistance.

Oscilloscope

An oscilloscope is a laboratory instrument used to analyse the waveform of electronic signals. It plots the instantaneous signal voltage over time and can display waveforms for both AC and DC currents with frequencies ranging from 1 Hz to several gigahertz. High-end oscilloscopes can handle very high-frequency signals.

Choosing the Right Instrument

When selecting an electrical measuring instrument, consider the range of values it can measure and its accuracy. Instruments with a wider range are more versatile, but selecting the correct range for the measurement is crucial for accuracy. For example, using a low-range meter for high currents or a high-range meter for low voltages will yield inaccurate readings.

Safety is paramount when using electrical measuring instruments. Always ensure the circuit is de-energized before making connections, and wear appropriate personal protective equipment, such as rubber gloves and safety glasses, to protect yourself and your equipment.

Understanding the capabilities and features of different electrical measuring instruments is crucial for making informed decisions and ensuring the safe and efficient operation of electrical systems. Whether you need a multimeter, ammeter, voltmeter, wattmeter, ohmmeter, or oscilloscope, each instrument has unique strengths that can meet your specific needs. When choosing a tool, consider the type of circuit (DC or AC), the range of values, and the accuracy required for your measurements.

(*Taken from:* https://beemet.com/guide-on-electrical-measuring-instruments/)

III. Choose the right option according to the text.

1. What is the primary function of a multimeter?

a) to measure voltage *b) to measure current*

c) to measure resistance

d) to measure multiple electrical quantities including voltage, current, and resistance

2. In which type of circuits is an ammeter typically connected?

a) in parallel *b) in series*

c) both in series and parallel *d) none of the above*

3. What unit of measurement does a voltmeter use?

a) amperes *b) ohms*

c) watts *d) volts*

4. How is a wattmeter used in electrical systems?

a) to measure electrical potential difference

b) to measure current

c) to measure power or the rate of energy use

d) to measure resistance

5. What does an ohmmeter measure?

a) voltage *b) current*

c) resistance *d) power*

6. Which instrument is used to analyse the waveform of electronic signals?

a) multimeter *b) ammeter*

c) oscilloscope *d) wattmeter*

7. When using a voltmeter, how should it be connected to the circuit?

a) in series *b) in parallel*

c) in a combination of series and parallel

d) directly across the power supply

8. What is the unit of measurement for power that a wattmeter provides?

a) amperes *b) ohms*

c) watts *d) volts*

9. Which electrical measuring instrument is typically used for troubleshooting electrical systems?

a) ohmmeter *b) oscilloscope*

c) multimeter *d) wattmeter*

10. What should be ensured before making connections with electrical measuring instruments?

a) the instrument is calibrated

b) the circuit is de-energized

c) the circuit is energized

d) the instrument is set to its highest range

IV. Complete each sentence with the correct verb.

Measure, analyze, display, connect, calibrate, troubleshoot, inspect, determine.

1. A multimeter can _____ multiple electrical quantities such as voltage, current, and resistance.

2. An oscilloscope is used to _____ the waveform of electronic signals over time.

3. Voltmeters _____ the electrical potential difference between two points in a circuit.

4. Before using any measuring instrument, you should _____ it to ensure accuracy.

5.To find out if a circuit is functioning correctly, technicians often _____ it for faults or issues.

6. A wattmeter helps to _____ the power being used in a circuit by calculating the product of voltage and current.

7. When measuring current, an ammeter needs to be _____ in series with the circuit.

8. In order to check the condition of a resistor, you should _____ its resistance with an ohmmeter.

V. Match the beginning of each sentence (left column) with the correct ending (right column).

1. A multimeter is used to…	a) the electrical potential difference between two points in a circuit.
2. An ammeter should be…	b) measure multiple electrical quantities, such as voltage, current, and resistance.
3. A voltmeter measures…	c) be connected in series with the circuit.

4. Before using any electrical measuring instrument, you should…	d) calibrate the instrument.
5. An oscilloscope helps to	e) analyse the waveform of electronic signals over time.
6. A wattmeter calculates	f) the power being used in a circuit by calculating the product of voltage and current.
7. An ohmmeter checks	g) the electrical resistance of a component or circuit.
8. To ensure accurate readings, it's important to..	h) ensure the circuit is de-energized before making connections.

VI. Make the sentences using the words.

Voltmeter, ammeter, ohmmeter, multimeter, oscilloscope, clamp meter, power meter, frequency counter, insulation tester, LCR meter, wattmeter, data logger.

VII. Translate the following sentences into English

1. Щоб виміряти струм, використовуйте амперметр.
2. У паралельному з'єднанні напруга однакова на всіх компонентах.
3. Вимірювач опору називається омметр.
4. Осцилограф використовується для перегляду форми сигналу.
5. Точність вимірювання залежить від калібрування вольтметра.
6. Ватметр вимірює потужність в електричному колі.
7. Безпека під час вимірювання є найважливішим фактором.
8. Діапазон частот, який можна виміряти, залежить від приладу.

VIII. Complete the text with the missing words from the box.

Multimeter, parallel, ammeter, measurement, voltmeter, accuracy, wattmeter, safety, ohmmeter, frequency, oscilloscope, waveform, power, signal, series, range.

1. A _____ is a versatile tool that can measure voltage, current, and

resistance.

2. To measure current in a circuit, you should use an _____ .

3. When measuring voltage across a component, connect the _____ in _____ to that component.

4. _____ is crucial when working with electrical devices to prevent accidents.

5. For testing the resistance of a component, an _____ is required.

6. The _____ of a voltage measurement depends on the _____ of the _____ used.

7. An _____ is used to visualize the _____ of a _____.

8. The _____ provides information on the electrical _____ being consumed in a circuit.

9. In a _____ circuit, the components are connected one after another.

10. The _____ of frequencies a device can measure is specified in its technical documentation.

IX. Speaking.

Take a few minutes to review the key points about electrical measuring instruments and their uses. Think about the specific instruments you are familiar with or have used, and their applications in different scenarios.

Task: imagine you are explaining to a friend who is new to electrical engineering about electrical measuring instruments. Your task is to discuss the following points:

– introduce electrical measuring instruments: briefly describe what electrical measuring instruments are and why they are important.

– explain different instruments:

– multimeter: explain what a multimeter is and what it measures.

– ammeter: describe how an ammeter is used to measure current and its importance in a circuit.

– voltmeter: discuss the role of a voltmeter in measuring voltage.

– wattmeter: talk about what a wattmeter measures and why it is used.

– ohmmeter: describe how an ohmmeter is used to measure resistance.

– oscilloscope: explain the purpose of an oscilloscope and what it

displays.

X. Writing.

Write a short essay (150-200 words) on the following topic:

"The Role and importance of electrical measuring instruments in electrical systems".

In your essay, cover the following points:

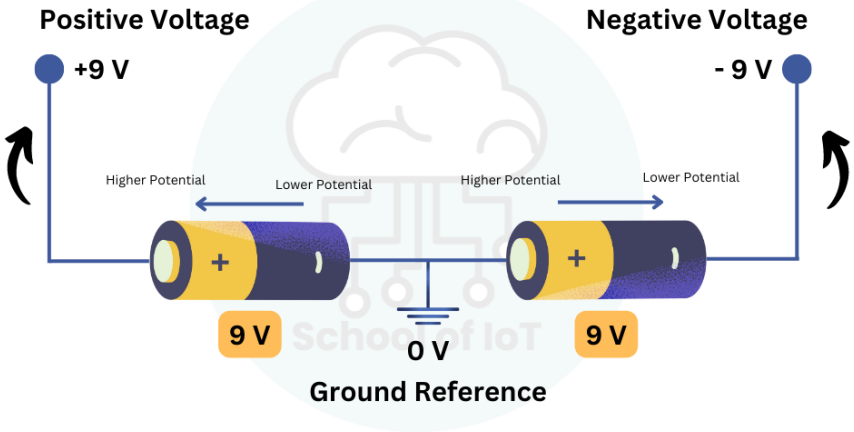
1. Introduction: briefly introduce what electrical measuring instruments are and their general purpose.

2. Types of instruments: describe the main types of electrical measuring instruments (e.g., multimeter, ammeter, voltmeter, wattmeter, ohmmeter, oscilloscope).

3. Practical Examples: provide a real-life example or scenario where one or more of these instruments would be used. Explain how the correct use of these instruments can impact the performance and safety of electrical systems.

4.Conclusion: summarize the importance of using the correct measuring instrument for accurate measurements and the overall maintenance of electrical systems.

Unit 3. Elements of electrical networks.
Open networks and their calculation.



Basic Vocabulary

1. electrical networks
2. interconnected components
3. power sources
4. electric current
5. series connections
6. parallel connections
7. open network
8. open circuit
9. flow of current
10. circuit design
11. troubleshooting electrical systems
12. detect an open circuit
13. incomplete circuit
14. voltage across the break
15. switch is turned off
16. disconnected wire
17. component failure
18. source voltage
19. significant voltage
20. circuit interruption

I. Complete the sentences with the correct word combinations from the box below.

Incomplete circuit, circuit design, open circuit, power sources, troubleshooting electrical systems, voltage across the break, disconnected wire, significant voltage.

1. An _____ prevents the flow of electric current because there is a break in the circuit.

2. During _____ , engineers look for faults like a _____ or a failed

component.

3. An _____ can be detected when the light bulb does not turn on despite being connected to _____ .

4. In an _____ , even though no current flows, the _____ may still be present.

5. _____ often results in a _____ that could damage components.

II. Match the words on the left with their corresponding definitions on the right.

1. Series connections	a. A type of circuit connection where components are connected one after another.
2. Parallel connections	b. The reason a device does not work even though it is plugged in.
3. Voltage across the break	c. The total voltage supplied by the power source.
4. Switch is turned off	d. A situation where no current can flow due to a break in the circuit.
5. Open network	e. What remains even when no current flows in an open circuit.
6. Source voltage	f. A type of circuit connection where components are connected side by side.
7. Circuit interruption	g. The flow of electrical charge through a conductor.
8. Electric current	h. The act of cutting off the path of current, intentionally or unintentionally.

III. Read and translate the text.

Elements of Electrical Networks:
Open Networks and their Calculation

Electrical networks are systems composed of interconnected electrical components such as resistors, capacitors, inductors, and power sources. These components form circuits that allow electric current to flow and perform various functions, such as lighting a bulb, powering a motor, or processing signals in electronic devices.

In an electrical network, components can be arranged in different configurations, including series and parallel connections.

Understanding these configurations is crucial for analysing how current, voltage, and resistance behave within the network.

An open network, also known as an open circuit, is a specific condition in which the circuit is incomplete, preventing the flow of electric current. This situation can occur when a switch is turned off, a wire is disconnected, or a component fails. In an open circuit, even though voltage may be present, there is no path for current to flow, so the circuit is essentially inactive. This is why a light bulb, for example, does not light up when the switch is off.

Calculating the behaviour of an open network involves determining the voltage and current in the circuit when it is open. Since no current flows through an open circuit, the current is zero. However, the voltage across the break or gap in the circuit can be significant, depending on the power source. This voltage is often equal to the source voltage since there is no other path for the current.

Open circuits are important in both circuit design and troubleshooting. For instance, knowing how to detect an open circuit can help locate faults in electrical systems, such as a broken wire or a damaged component. Moreover, understanding how open circuits behave allows engineers to design circuits that can safely handle situations where the circuit is intentionally or unintentionally interrupted.

In summary, electrical networks consist of various components that work together to manage the flow of electricity. An open network occurs when there is a break in the circuit, stopping the flow of current. Calculating and understanding these open circuits is essential for maintaining the reliability and safety of electrical systems.
(*Taken from*: https://akshayansinha.medium.com/part-1-the-theory-of-electrical-networks-c42364381481)

IV. Answer the following questions based on the text.

1. What are the main components of an electrical network?
2. What happens in an open network?
3. How can an open circuit occur?
4. What is the current in an open circuit?
5. Why does a light bulb not light up in an open circuit?
6. What does calculating an open network involve?

7. How can detecting an open circuit help in troubleshooting?
8. Why is understanding open circuits important for engineers?

V. Decide whether the following statements are true or false.

1. An open circuit allows electric current to flow through it. True/false
2. In a series connection, the components are connected one after another. True/false
3. A closed circuit has a break that prevents current from flowing. True/false
4. Parallel connections in a circuit allow current to flow through multiple paths. True/false
5. The voltage across an open circuit is always zero. True/false
6. Troubleshooting electrical systems may involve checking for a disconnected wire. True/false
7. A significant voltage can be present across a break in an open circuit. True/false

VI. Match Ukrainian equivalents with English technical terms.

1. electrical network	a. розімкнуте коло
2. open circuit	b. гілка
3. node	c. джерело струму
4. branch	d. вузол
5. voltage drop	e. паралельне з'єднання
6. current source	f. розрахунок опору
7. load	g. падіння напруги
8. resistance calculation	h. послідовне з'єднання
9. Kirchhoff's laws	i. еквівалентний опір
10. equivalent resistance	j. закон Кірхгофа
11. series connection	k. навантаження
12. parallel connection	l. електрична мережа

VII. Match each sentence half on the left with the correct half on the right.

1. An electrical network is ...	a) ... does not flow due to a break in the circuit.
2. In an open circuit, the current	b) ... the opposition to the flow

...	of electric current.
3. Resistance is a measure of ...	c) ... is the sum of individual resistances.
4. The voltage across an open circuit ...	d) ... remains constant if the circuit is open.
5. Conductors in a network allow ...	e) ... how much resistance the circuit has.
6. An open circuit can occur when ...	f) ... a break or disconnect occurs in the circuit.
7. The total resistance in a series circuit ...	g) ... is equal to the sum of the currents in each branch.
8. In parallel circuits, the total current ...	h) ... a combination of electrical components connected together.
9. The power consumed in an electrical network ...	i) ... the flow of current through the circuit.
10. To calculate the voltage drop, you need to know ...	j) ... depends on the current and resistance in the circuit.

VIII. Translate the following sentences into English.

1. Відкритий контур не дозволяє струму текти через нього.
2. Вимірювання напруги в розімкнутій мережі може бути важливим для діагностики проблем.
3. Коли вимикач вимкнено, електричний ланцюг переривається.
4. Перевірка несправностей в електричних системах може включати пошук відключеного дроту.
5. Конфігурація з’єднань в серії дозволяє струму текти лише через один шлях.
6. В електричній мережі з паралельними з'єднаннями кожен компонент має окремий шлях для струму.
7. Джерела живлення постачають електричну енергію до мережі.
8. У випадку поломки компонента, важливо зрозуміти, як це вплине на загальний електричний ланцюг.

IX. Speaking.

Topic: Troubleshooting Electrical Systems

Instructions:

1.Describe a Scenario: Imagine you are an electrician who has been called to fix a problem in a house where the lights are not working. The homeowner has reported that the lights suddenly went out and won't turn on.

2. Discuss Possible Issues:

– Explain what might be causing the problem. Consider factors like an open circuit, a disconnected wire, or a faulty component.

– Describe the steps you would take to diagnose and fix the issue. Talk about how you would check the circuit and what tools you might use.

3. Role-Play:

– Pair up with a classmate. One person plays the electrician, and the other plays the homeowner. Have a conversation where the homeowner explains the issue and the electrician asks questions and gives advice on how to fix the problem.

4. Questions to Consider

– What could be the possible cause of the lights not working?

– How would you check if the circuit is open?

– What tools would you use to troubleshoot the problem?

X. Writing.

1. Write a Short Essay: Topic: Understanding Open Circuits. (150-200 words) explaining what an open circuit is and why it is important to understand how it works.

2. Include the Following Points:

– Define what an open circuit is.

– Explain how an open circuit can occur in a real-life situation.

– Describe the effects of an open circuit on the flow of electric current.

– Discuss why knowing about open circuits is important for electrical troubleshooting and safety.

Unit 4. Basic concepts.
Operating modes of electrical networks.

Basic Vocabulary

1. electric charge	11. closed circuit
2. electron flow	12. electrical conductor
3. positive charge	13. energy transfer
4. atom structure	14. insulating material
5. negative charge	15. nucleus composition
6. current flow	16. electric field
7. electrical circuit	17. proton count
8. voltage drop	18. neutron number
9. open circuit	19. circuit continuity
10. resistance level	20. power measurement

I. Translate the following word combinations into Ukrainian.

1. Multimeter reading, parallel circuit, ammeter connection, voltage measurement, series circuit, power signal, circuit range, oscilloscope waveform, measurement accuracy, frequency response, ohmmeter usage, wattmeter calibration, electrical safety, signal interference, circuit analysis.

II. Match the words on the left with their corresponding definitions on the right.

1. Electrical impedance	A device or system that provides electrical energy to a load or circuit.
2. Circuit breaker	The resistance presented by the components connected to the output of a circuit or power source.
3. Power supply	The magnetic core of a transformer that provides a path for magnetic flux.
4. Load resistance	The opposition to the change in current flow by an inductor in an AC circuit.
5. Alternating current (AC)	An electric current that periodically reverses direction.
6. Direct current (DC)	A safety device that automatically stops the flow of current in an electric

	circuit if it becomes overloaded.
7. Transformer core	An electric current that flows in one direction only.
8. Inductive reactance	The opposition to the change in voltage across a capacitor in an AC circuit.
9. Capacitive reactance	The total opposition to the flow of alternating current in a circuit, including resistance and reactance.
10. Fuse protection	A safety device that interrupts the flow of current in a circuit when it exceeds a certain level, preventing damage or fire.

III. Read and translate the text.

Basic Concepts and Operating Modes of Electrical Networks

Electrical networks are systems that connect electrical components to transfer and distribute electric energy. These networks can operate in various modes, depending on the type of current, circuit configuration, and the components involved.

One of the basic concepts in electrical networks is current, which refers to the flow of electric charge through a conductor. There are two types of current: Alternating Current (AC) and Direct Current (DC). AC changes direction periodically, while DC flows in only one direction.

Another important concept is voltage, the potential difference between two points in a circuit, which drives the current. Resistance is the opposition to current flow, and it is influenced by the material and size of the conductor.

Electrical networks can be configured as series circuits or parallel circuits. In a series circuit, components are connected end-to-end, so the current is the same throughout. In a parallel circuit, components share the same voltage, but the current is divided among them.

Impedance is a concept that combines resistance with reactance – the opposition to AC due to inductors and capacitors. Circuit breakers and fuses are safety devices that protect electrical networks from

overloads by interrupting the current flow when necessary.

The operating mode of an electrical network depends on how these components interact. For instance, the network can operate under normal, overload, or fault conditions. Grounding is an essential safety measure that provides a path for excess current to prevent accidents. (*Taken from*: https://www.sciencedirect.com/topics/computer-science/electrical-network)

IV. Answer the following questions based on the text.

1. What are the two types of electric current?
2. How does Alternating Current (AC) differ from Direct Current (DC)?
3. What is the role of voltage in an electrical circuit?
4. How does resistance affect the flow of current in a circuit?
5. What is the difference between a series circuit and a parallel circuit?
6. What is impedance, and how does it relate to AC circuits?
7. Why are circuit breakers and fuses important in electrical networks?
8. What does grounding do in an electrical network?
9. How can the operating mode of an electrical network be described?
10. What happens when a circuit is overloaded?

V. Complete the sentences with the correct verb from the list above.

Generate, transmit, distribute, consume, connect, measure, control, protect, transform, regulate.

1. Power plants _____ electricity to supply homes and industries.
2. Electrical networks are designed to _____ power from the source to the end-users.
3. Transformers _____ voltage levels to match the needs of different devices.
4. Circuit breakers _____ electrical circuits from overloads and short circuits.
5. Meters are used to _____ the amount of electricity used by consumers.

6. Control systems _____ the flow of electricity within the network.

7. Electrical energy is _____ by various appliances and machines in homes and industries.

8. Wires and cables _____ different parts of the electrical network together.

9. The network must _____ voltage and frequency to ensure stable operation.

10. Power is _____ from generation stations to substations before reaching consumers.

VI. Complete these sentences using the appropriate field-related vocabulary.

1. Electrical networks are designed to ensure the _____ of power from the generating station to the end-user.

2. A _____ is used to measure the amount of electrical energy consumed by a household or business.

3. Transformers adjust the _____ of electricity to match the requirements of different devices.

4. In a closed circuit, the electrical current flows continuously without any _____ .

5. Circuit breakers protect the network by interrupting the flow of current in case of an _____ .

6. Electrical _____ , such as wires and cables, are essential for connecting different components of the network.

7. To maintain stable operation, the network must regulate both _____ and frequency.

8. High-voltage transmission lines are necessary to reduce _____ losses over long distances.

VII. Make the sentences using the words.

Voltage, current, resistance, transformer, conductor, insulator, circuit, load, frequency, switch, substation, overload.

VIII. Choose the right option.

1. The primary function of a (transformer / insulator) is to adjust the voltage levels within the electrical network.

2. Electrical (conductors / insulators) allow the flow of electric current through the circuit.

3. High (voltage / resistance) transmission lines are used to transport electricity over long distances.

4. A closed (circuit / switch) ensures that electrical current flows continuously without interruption.

5. (Frequency / voltage) refers to the number of cycles per second in an alternating current.

6. Circuit breakers are used to protect the network from (overload / frequency) issues.

7. Electrical networks must maintain stable (voltage / load) to ensure reliable power delivery.

8. A (substation / transformer) is a facility where voltage levels are adjusted before electricity is distributed to consumers.

IX. Speaking.

Task 1: Describe the process

– Describe how electricity is generated, transmitted, and distributed to homes. Use key terms such as “voltage,” “transformer,” “substation,” and “conductor.” Speak for about 2 minutes.

Task 2: Explain the concepts

– Explain what a closed circuit is and why it is important in electrical networks. Include the terms “current,” “resistance,” and “circuit breaker.” Speak for about 1-2 minutes.

Task 3: Discuss safety measures

– Talk about the safety measures taken to protect electrical networks from overloads. Use the terms “circuit breaker,” “insulator,” and “overload.” Speak for about 1-2 minutes.

X. Writing.

Topic: Explain the Importance of Stable Voltage and Frequency in Electrical Networks

Instructions:

Write a short essay (150-200 words) explaining why maintaining stable voltage and frequency is crucial for the reliable operation of electrical networks. In your essay, address the following points:

– The role of voltage and frequency in the transmission of

electricity.

– The impact of fluctuations in voltage and frequency on electrical devices.

– Measures taken to ensure stability in electrical networks.

Use the following vocabulary in your writing: voltage, frequency, circuit, transformer, substation, overload, and stability.

Example Sentence Starter:

"Stable voltage and frequency are essential for ensuring that electrical networks operate efficiently and safely..."

Unit 5. Transformers in electrical engineering.

Lead-in

Discuss these questions with your partner.

- What is a transformer?
- What are transformers used for?
- What are the principal parts of a transformer?

Basic vocabulary

transformer	cooling system
primary coil	flux leakage
secondary coil	overload
magnetic field	isolation transformer
step-up/ step-down transformer	regulation
core	tap
winding	mutual induction
load	impedance
urns ratio	inductance

I. Match Ukrainian equivalents with English technical terms.

1. a piece of apparatus	a) співвідношення витків
2. turns ratio	b) сталеве осердя
3. no-load current	c) падіння напруги
4. paper insulation	d) електромагнітна індукція
5. voltage drops	e) окремий прилад
6. load current	f) струм навантаження
7. steel core	g) струм холостого ходу
8. electromagnetic induction	h) паперова ізоляція

II. Match the words on the left with their corresponding definitions on the right.

1. transformer	A. the central part of a transformer, usually made of iron, around which the coils are wound.
2. primary coil	B. a transformer that increases the voltage from primary to secondary coil.
3. step-up transformer	C. the part of a transformer where the electrical current first enters.
4. impedance	D. the total opposition a transformer offers to the flow of alternating current.
5. core	E. a device that changes the voltage of an electrical current.
6. tap	F. a connection point on the transformer winding used to adjust the voltage output.
7. cooling system	G. the portion of the magnetic flux that does not follow the intended path within the transformer core.
8. flux leakage	H. the mechanism used to dissipate heat generated in a transformer, such as oil or air cooling.

III. Read the text about the principles of transformer operation. Choose from the sentences (A-E) the one which fits each gap. There is one extra sentence.

A. During the instant of switch closing, buildup of current and magnetic field occurs.

B. This reduces the back voltage (back EMF) of the primary and causes the primary current to increase.

C. The cores of transformers are usually built up with laminations of silicon steel.

D. Note that the primary is always connected to the source of power, and the secondary is always connected to the load.

E. When current is reduced, the magnetic field shrinks.

F. Alternating magnetic lines of force, called ‘flux’, circulate through the core.

Principles of Operation

A transformer is a piece of apparatus which has no internal moving parts, and it transfers energy from one circuit to another by electromagnetic induction. When one winding of a transformer is energised from an alternating current (AC) source, an alternating magnetic field is established in the transformer core. 1_____ With a second winding around the same core, a voltage is induced by the alternating flux lines. A circuit, connected to the terminals of the second winding, results in current flow. Each phase of a transformer is composed of two separate coil windings wound on a common core. The low-voltage winding is placed nearest the core; the high-voltage winding is then placed around both the low voltage winding and core. The core is typically made from very thin steel laminations, each coated with insulation. By insulating between individual laminations, losses are reduced. The steel core provides a low resistance path for magnetic flux. Both high- and low-voltage windings are insulated from the core and from each other, and leads are brought out through insulating bushings. A three-phase transformer typically has a core with three legs and has both high voltage and low-voltage windings around each leg. Special paper and wood are used for insulation and internal structural support. Transformer Action Transformer action depends upon magnetic lines of force (flux) mentioned above. At the instant a transformer primary is energised with AC, a flow of electrons (current) begins. 2_____ As current begins the positive portion of the sine wave, lines of magnetic force (flux) develop outward from the coil and continue to expand until the current is at its positive peak. The magnetic field is also at its positive peak. The current sine wave then begins to decrease, crosses zero, and goes negative until it reaches its negative peak. The magnetic flux switches direction and also reaches its peak in the opposite direction. With an AC power circuit, the current changes continually 60 times per second, which is standard in the United States. Other countries may use other frequencies. In Europe, 50 cycles per second is common. Strength of a magnetic field depends on the amount of current and number of turns in the winding. 3_____ When the current is switched off, the magnetic field collapses. When a coil is placed in an AC circuit, as shown in figure 2, current in the primary coil will be accompanied by a constantly rising

and collapsing magnetic field. When another coil is placed within the alternating magnetic field of the first coil, the rising and collapsing flux will induce voltage in the second coil. When an external circuit is connected to the second coil, the induced voltage in the coil will cause a current in the second coil. The coils are said to be magnetically coupled; they are, however, electrically isolated from each other. Many transformers have separate coils, as shown in Figure 2, and contain many turns of wire and a magnetic core, which forms a path for and concentrates the magnetic flux. The winding receiving electrical energy from the source is called the primary winding. The winding which receives energy from the primary winding, via the magnetic field, is called the 'secondary' winding. The amount of voltage induced in each turn of the secondary winding will be the same as the voltage across each turn of the primary winding. The total amount of voltage induced will be equal to the sum of the voltages induced in each turn. Therefore, if the secondary winding has more turns than the primary, a greater voltage will be induced in the secondary; and the transformer is known as a step-up transformer. If the secondary winding has fewer turns than the primary, a lower voltage will be induced in the secondary; and the transformer is a stepdown transformer. In actual practice, the amount of power available from the secondary will be slightly less than the amount supplied to the primary because of losses in the transformer itself. The voltage induced in the primary circuit opposes the applied voltage and is known as back voltage or back electro-motive-force (back EMF). When the secondary circuit is open, back EMF, along with the primary circuit resistance, acts to limit the primary current. Primary current must be sufficient to maintain enough magnetic field to produce the required back EMF. When the secondary circuit is closed and a load is applied, current appears in the secondary due to induced voltage, resulting from flux created by the primary current. This secondary current sets up a second magnetic field in the transformer in the opposite direction of the primary field. Thus, the two fields oppose each other and result in a combined magnetic field of less strength than the single field produced by the primary with the secondary open. 5_____ The primary current increases until it reestablishes the total magnetic field at its original strength. In transformers, a balanced

condition must always exist between the primary and secondary magnetic fields. Volts times amperes must also be balanced on both primary and secondary. The required primary voltage and current must be supplied to maintain the transformer losses and secondary load. (*Taken from*: https://www.usbr.gov/tsc/techreferences/mands/mands-pdfs/Trnsfrmr.pdf)

IV. Put the words in the correct order to make sentences about transformer operation.

The first and the last words are in the right places.

1. The main, between, of, transformer, mutual, two, principle, is, operation, a, inductance, circuits.

2. A basic, coils, that transformer, of, two, electrically, are, and, separate, consists, inductive.

3. Mutual, two, or, energy, windings, induction, between, allows, electrical, to be, between, transferred, more, circuits.

4. The alternating, continually, the, that, current, surrounds, flowing, the, flux, produces, winding, a, and, changing, alternating, through, winding.

5. If another, second, is, winding, to, brought, some, close, winding, this, this, portion, of, link, will, alternating, with, flux, the, winding.

6. According, be, electromagnetic, in, Faraday's, to, the, law, of, an, induction, there, second, will, induced, EMF, winding.

7. If the circuit, is, this, will, secondary, of, closed, then, winding, a, flow, current, through it

V. Complete the sentences with the correct verb from the list above.

Isolate, induce, increase, decrease, dissipate, flow, exceed, withstand, reverse, establish.

1. A step-up transformer is used to _____ the voltage in a circuit.

2. The cooling system is designed to _____ the heat generated in the transformer.

3. In a transformer, mutual induction _____ a voltage in the secondary coil.

4. An isolation transformer is used to _____ circuits for safety

purposes.

5. The magnetizing current is necessary to _____ a magnetic field in the core.

6. When the current _____ the transformer's capacity, an overload occurs.

7. Alternating current (AC) _____ direction periodically, unlike direct current (DC).

8. The insulation material must be able to _____ electric stress without breaking down.

9. In a step-down transformer, the voltage is _____ to a lower level.

10. The current _____ through the transformer winding to create an electromagnetic field.

VI. Translate the following sentences into English.

1. Трансформатор використовується для зміни напруги в електричному колі.

2. Первинна обмотка трансформатора підключається до джерела живлення.

3. Струм, що протікає через вторинну обмотку, викликає появу магнітного поля.

4. Трансформатор знижуючий використовується для зменшення напруги.

5. Втрати на магнітному потоці в трансформаторі можуть спричинити нагрівання осердя.

6. Випробування на ізоляцію проводять для перевірки здатності трансформатора витримувати електричні навантаження.

VII. Choose the appropriate word to fill in the gaps in the sentences below.

1. Transformer’s work depends upon magnetic lines of force which can also be called … .

a) stream *b) current* *c) flow* *d) flux*

2. Both the primary and the secondary windings are usually wound on the same … .

a) core *b) coil* *c) armature* *d) anchor*

3. The core is usually made from very thin … laminations

a) iron b) steel c) metal d) silicon

4. Magnetically coils are not electrically connected to each other.

a) doubled b) paired c) coupled d) connected

5. The primary and secondary magnetic … must always be balanced.

a) fields b) lines c) fluxes d) forces

VIII. Match each sentence half on the left with the correct half on the right.

1. A transformer is used to ...	a. ... is connected to the power source.
2. The primary coil of a transformer ...	b. ... iron, to guide the magnetic flux.
3. A step-up transformer ...	c. ... increases the voltage from the primary to the secondary coil.
4. Flux leakage in a transformer ...	d. ... reduce the risk of overheating.
5. The core of a transformer is made of ...	e. ... affects the efficiency of the transformer.
6. Cooling systems in transformers are essential to ...	f. ... adjust the voltage output.
7. The tap on a transformer winding ...	g. ... change the voltage in an electrical circuit.

IX. Speaking.

Choose one of the topics below and speak for 2-3 minutes. Try to use as much relevant vocabulary as possible from the lists you've studied.

1. Explain the function of a transformer:

– Describe what a transformer does.

– Explain the difference between a step-up and a step-down transformer.

– Mention how the primary and secondary coils work.

2. Describe the importance of the core in a transformer:

– Explain what the core is made of and its role.

– Discuss how the core influences the efficiency of a transformer.

– Talk about the problems associated with flux leakage.

3. Discuss the role of cooling systems in transformers:

– Explain why cooling is necessary in transformers.

– Describe the different types of cooling systems that might be used.

– Mention the consequences of inadequate cooling.

X. Writing.

Write a short paragraph (100-150 words). Use the relevant vocabulary and concepts related to transformers in electrical engineering.

1. The Role of Transformers in Power Distribution:

– Explain how transformers are used in the distribution of electrical power.

– Mention the importance of step-up and step-down transformers in this process.

– Discuss how transformers help in reducing energy loss during transmission.

Unit 6. High Voltage Engineering.

Basic Vocabulary

high voltage	impulse voltage
insulation	surge
overvoltage	capacitance
transmission	grounding
distribution	bushing
breakdown voltage	switchgear
corona discharge	partial discharge
dielectric	lightning arrester
arc	creepage distance
circuit breaker	resonant overvoltage

I. Match Ukrainian equivalents with English technical terms.

1. high voltage	a) електрична ємність
2. insulation	b) висока напруга
3. circuit breaker	c) перенапруга
4. grounding	d) заземлення

5. lightning arrester	e) вимикач
6. corona discharge	f) грозозахисний розрядник
7. overvoltage	g) діелектрик
8. dielectric	h) ізоляція
9. capacitance	i) корона розряд

II. Match the words on the left with their corresponding definitions on the right.

1. dielectric	a. the ability of a material to store electrical energy by maintaining an electric charge.
2. overvoltage	b. a layer or material applied to electrical components to prevent unwanted current flow and protect against electrical hazards.
3. corona discharge	c. an electrical fault condition where the voltage exceeds the normal operating range, which can damage equipment.
4. lightning arrester	d. a device that automatically interrupts the electrical circuit to prevent damage and ensure safety when an abnormal condition is detected.
5. grounding	e. the process of connecting electrical equipment to the earth to safely dissipate fault currents and stabilize the electrical system.
6. circuit breaker	f. a material used to isolate different electrical components and prevent unintended electrical discharge or leakage.
7. insulation	g. a device that protects electrical systems from damage by diverting excess voltage caused by lightning to the ground.
8. capacitance	h. a phenomenon where an electrical field causes ionization of the surrounding air, resulting in a visible or audible discharge around a conductor.

III. Read and translate the text.

High Voltage Engineering

High voltage engineering is a specialized and critical field within electrical engineering that focuses on the generation, transmission, and

distribution of electrical energy at high voltages. This discipline is fundamental to the efficient transmission of electricity over long distances, minimizing energy losses and ensuring the stability of power systems that serve both urban and rural areas. The challenges in high voltage engineering are unique, as they involve managing extremely high electrical potentials that require specialized equipment, materials, and techniques to ensure safety, reliability, and efficiency.

One of the key elements in high voltage engineering is insulation. Insulation materials are designed to prevent unintended flow of electricity, containing high voltage energy within the designated conductors. Common insulation materials include dielectrics, which are non-conductive and prevent electrical discharge, and bushings, which insulate and support the conductors passing through grounded barriers like transformer casings. The effectiveness of these materials is often measured by their breakdown voltage – the maximum voltage they can withstand before failing. Exceeding this breakdown voltage can result in insulation failure, leading to dangerous arcing, equipment damage, and potential safety hazards.

To safeguard high voltage systems, various protective devices are employed. Circuit breakers are essential components that can interrupt the flow of electricity in the event of an overvoltage or surge, thereby protecting equipment from damage and ensuring operational safety. Lightning arresters are another critical protective measure; they safeguard high voltage systems from lightning-induced surges by diverting the excessive voltage away from sensitive equipment and into the ground, preventing catastrophic failures.

Grounding, or earthing, is another vital aspect of high voltage engineering. Proper grounding ensures that electrical systems are connected to the earth, which serves as a reference point for voltages in the system. This connection helps prevent electric shock, provides a safe path for fault currents, and dissipates surge currents safely into the ground. Without proper grounding, high voltage systems would pose significant risks to both human safety and equipment integrity.

High voltage testing plays a crucial role in maintaining the reliability and safety of these systems. Various testing techniques are used to evaluate the performance of insulation and the overall

reliability of high voltage equipment. Impulse voltage testing, for instance, simulates lightning strikes to assess the ability of insulation to withstand sudden high-voltage surges. Partial discharge measurement is another important test, used to detect localized insulation failures before they can lead to complete breakdowns.

In addition to these technical aspects, high voltage engineering also involves rigorous design considerations, system analysis, and ongoing maintenance to ensure the long-term stability and efficiency of power systems. Engineers must carefully balance the demands of high voltage transmission with the need for safety, cost-effectiveness, and environmental impact. Advances in materials science, control systems, and diagnostic tools continue to enhance the capabilities of high voltage engineering, making it an ever-evolving field that is crucial to the modern electrical infrastructure.

Overall, high voltage engineering is indispensable for the safe and efficient delivery of electrical energy across vast distances. It requires a deep understanding of electrical principles, material science, and safety protocols to design, operate, and maintain the high voltage systems that power our world.

(*Adapted from*:
https://www.mv.helsinki.fi/home/tpaulin/Text/hveng.pdf)

IV. Answer the following questions based on the text.

1. What is the role of insulation in high voltage engineering?
2. Why is grounding important in high voltage systems?
3. What is the purpose of a circuit breaker in a high voltage circuit?
4. How does a lightning arrester protect high voltage equipment?
5. What happens when the breakdown voltage of an insulator is exceeded?
6. What are some materials used for insulation in high voltage engineering?
7. Why is high voltage engineering important for transmitting electricity over long distances?
8. What are some of the testing techniques used to assess the reliability of high voltage systems?

V. Complete the sentences with the correct verb from the list above.

Prevent, interrupt, withstand, manage, minimize, divert, monitor, reduce.

1. Grounding helps to _____ electric shock and ensures that surge currents are safely dissipated into the earth.

2. In high voltage systems, proper insulation is essential to _____ unintended electrical discharges and protect equipment.

3. Circuit breakers are designed to _____ the flow of electricity in a circuit during an overvoltage event.

4. Engineers must carefully _____ the insulation levels to withstand various voltage stresses within a high voltage system.

5. When designing high voltage transmission lines, it is important to _____ corona discharge to minimize energy loss and interference.

6. Lightning arresters are used to _____ lightning-induced surges away from sensitive equipment, protecting it from damage.

7. Regular testing is required to _____ the partial discharge levels and ensure the reliability of high voltage insulation.

8. Properly designed switchgear can _____ the effects of resonant overvoltage, protecting the overall system from excessive voltage stress.

VI. Choose the appropriate word to fill in the gaps in the sentences below.

1. Proper _____ is essential in high voltage systems to prevent unintended electrical discharges and ensure the safety of the equipment.

a) insulation *b) capacitance* *c) arc*

2. The _____ is used to interrupt the flow of electricity when an overvoltage is detected, protecting the system from damage.

a) circuit breaker *b) dielectric*

c) resonant overvoltage

3. Engineers must carefully design _____ to handle fault currents and ensure the safety of electrical installations.

a) switchgear *b) bushing*

c) creepage distance

4. If the _____ of an insulator is exceeded, it can result in

insulation failure and dangerous arcing.

a) breakdown voltage *b) partial discharge*

c) grounding

5. _____ is a phenomenon that occurs when the electric field around a conductor exceeds the air's breakdown strength, leading to energy loss.

a) Corona discharge *b) Voltage regulation*

c) Lightning arrester

6. A _____ is used to divert lightning-induced surges away from sensitive equipment, protecting it from potential damage.

a) lightning arrester *b) creepage distance*

c) capacitance

7. The purpose of _____ is to connect electrical systems to the earth, providing a path for fault currents and ensuring safety.

a) grounding *b) switchgear*

c) impulse voltage

8. Regular testing is required to monitor _____ levels and detect any insulation issues before they lead to system failure.

a) partial discharge *b) insulation coordination*

c) arc

VII. Translate the following sentences into English.

1. Належна ізоляція є важливою для захисту обладнання від небажаних електричних розрядів.

2. Вимикач автоматично перериває потік електрики під час перенапруги, запобігаючи пошкодженню системи.

3. Грозозахисні розрядники використовуються для захисту від перенапруг, викликаних блискавкою.

4. Якщо пробивна напруга ізолятора перевищується, це може призвести до небезпечного електричного пробою.

5. Заземлення забезпечує безпечний шлях для струмів замикання на землю, захищаючи систему від пошкоджень.

6. Регулярне тестування необхідне для виявлення часткових розрядів і запобігання збоям у роботі системи.

VIII. Match each sentence half on the left with the correct half on the right.

1. Proper insulation is essential to ...	a. monitor partial discharge levels and maintain system reliability
2. Circuit breakers are designed to ...	b. prevent the flow of fault currents and ensure safety.
3. Lightning arresters help to ...	c. prevent unintended electrical discharges in high voltage systems.
4. Breakdown voltage is the maximum voltage that ...	d. interrupt the flow of electricity during an overvoltage event.
5. Grounding is used to...	e. divert lightning-induced surges away from sensitive equipment.
6. Regular testing is necessary to...	f. an insulator can withstand before failure occurs.

IX. Speaking.

1. Explain the Role of Insulation:

– Discuss why insulation is crucial in high voltage systems and what materials are commonly used.

– Describe the consequences of insulation failure in high voltage equipment.

2. Describe the Function of a Circuit Breaker:

– Explain how a circuit breaker operates in a high voltage system.

– Give an example of a situation where a circuit breaker would be essential.

3. Discuss the Importance of Grounding:

– Talk about how grounding works and its significance in high voltage engineering.

– Explain what might happen if proper grounding is not implemented.

X. Writing.

Topic: The Importance of Insulation and Grounding in High Voltage Systems.

Instructions:

1. Introduction (150-200 words):

- Introduce the significance of high voltage systems in the electrical grid.

- Briefly explain why insulation and grounding are crucial components in these systems.

2. Body Paragraph 1: Insulation (200-250 words):
   - Define insulation in the context of high voltage engineering.
   - Describe the different types of insulation materials used and their properties.
   - Explain the role of insulation in preventing electrical failures and ensuring safety.
   - Provide examples of common insulation failures and their consequences.
3. Body Paragraph 2: Grounding (200-250 words):
   - Define grounding and its purpose in high voltage systems.
   - Discuss the methods of grounding and the materials commonly used.
   - Explain how grounding protects both people and equipment from electrical faults.
   - Describe the impact of inadequate grounding on system safety and performance.
4. Conclusion (150-200 words):
   - Summarize the key points about the importance of insulation and grounding.
   - Reflect on how advancements in these areas contribute to the overall reliability and safety of high voltage systems.
   - End with a statement on the future of insulation and grounding technologies in high voltage engineering.

Instructions:

- Write a well-structured essay based on the instructions above.
- Use clear and precise language, and include technical terms appropriately.
- Ensure that your essay is coherent and logically organized.
- After writing, review your work for accuracy, clarity, and completeness.

Unit 7. Electrical machines and their applications.

Basic Vocabulary

torque	capacitance
winding	AC (alternating current)

armature	DC (direct current)
commutator	induction
brush	rotor
load	stator
synchronous speed	servo / stepper motor
excitation	poles
rectifier	
inverter	stepper motor
bearing	duty cycle
slip Ring	voltage regulator

I. Match Ukrainian equivalents with English technical terms.

1. electric motor	a. котушка обмотки
2. magnetic field	b. напруга на зниження
3. power supply	c. електричний опір
4. rotating shaft	d. магнітне поле
5. coil winding	e. синхронна швидкість
6. synchronous speed	f. крутний момент навантаження
7. electrical resistance	g. електричний двигун
8. torque load	h. живлення
9. voltage drop	i. тепловий захист
10. thermal protection	j. обертовий вал

II. Match the words on the left with their corresponding definitions on the right.

synchronous speed	a. A system that protects electrical machines from overheating.
coil winding	b. The speed at which the magnetic field of a motor rotates.
thermal protection	c. A component that provides the necessary electrical power to a machine or system.
magnetic field	d. A rotating part that transfers current from a stationary to a moving part in a motor or generator.
slip ring	e. The winding of wire around a core to create an electromagnet or to induce

	current.
power supply	f. The force field created by a magnet or by moving electric charges.
electric motor	g. A device that maintains a constant voltage level in an electrical system.
voltage regulator	h. A machine that converts electrical energy into mechanical energy.
rotating shaft	i. The part of a machine that turns to create movement.
load resistance	j. The resistance offered by a load in an electrical circuit.

III. Read and translate the text.

Electrical machines and their applications

Electrical machines play a crucial role in modern technology and industrial processes. These machines are designed to convert energy from one form to another, making them essential in various applications, from household appliances to large industrial systems. The two most common types of electrical machines are electric motors and generators, each serving distinct purposes in energy conversion.

Electric motors are devices that convert electrical energy into mechanical energy. This mechanical energy is used to drive various machines and equipment. For instance, motors are found in everyday appliances such as refrigerators, air conditioners, and washing machines. In the industrial sector, electric motors power conveyor belts, pumps, and fans. Additionally, they are integral to the operation of electric vehicles, where they provide the necessary torque to turn the wheels.

There are different types of electric motors, each suited for specific applications. AC motors (Alternating Current motors) are commonly used in industries due to their durability and ability to operate at high speeds. DC motors (Direct Current motors), on the other hand, are preferred in applications where precise control of speed and position is required, such as in robotics and electric vehicles.

Generators perform the opposite function of motors; they convert mechanical energy into electrical energy. This process is fundamental in power generation, where mechanical energy from turbines, driven

by water, wind, or steam, is converted into electricity. The electricity produced by generators is then distributed to homes, businesses, and industries. Without generators, the widespread availability of electrical power would not be possible.

One of the critical components in both motors and generators is the rotor. The rotor is the rotating part of the machine, and it interacts with the stator, which is the stationary part that produces a magnetic field. The interaction between the rotor and the stator is what enables the conversion of energy. In electric motors, the rotor turns under the influence of the magnetic field, creating mechanical motion. In generators, mechanical motion is applied to the rotor, inducing an electrical current in the stator.

Transformers are another essential type of electrical machine. Unlike motors and generators, transformers do not convert energy from one form to another; instead, they transfer electrical energy between circuits through electromagnetic induction. Transformers are vital in the transmission and distribution of electrical power. They allow the voltage to be increased (stepped up) or decreased (stepped down) as needed. For example, in power plants, transformers step up the voltage for efficient transmission over long distances, and then other transformers step down the voltage for safe use in homes and businesses.

The efficiency of electrical machines is a critical factor in their design and application. Efficiency refers to the machine's ability to convert energy with minimal losses. High-efficiency machines are essential because they reduce energy consumption, lower operating costs, and decrease the environmental impact of energy use. Advances in materials and technology continue to improve the efficiency of electrical machines, making them more sustainable and reliable.

In summary, electrical machines are indispensable in modern life, powering everything from small household appliances to large industrial processes. Their ability to efficiently convert and transfer energy makes them a cornerstone of technological development and energy management.

(*Adapted from*: https://www.geeksforgeeks.org/types-of-electric-machines/)

IV. Answer the following questions based on the text.

1. What is the primary function of electrical machines?
2. What are the two most common types of electrical machines mentioned in the text?
3. How do electric motors differ from generators in terms of energy conversion?
4. In what everyday devices can electric motors be found?
5. Why are AC motors commonly used in industries?
6. What type of applications are DC motors preferred for?
7. How do generators contribute to power generation?
8. What roles do the rotor and stator play in the operation of electrical machines?
9. How do transformers help in the transmission and distribution of electrical power?
10. Why is efficiency important in the design and application of electrical machines?

V. Complete the sentences with the correct verb from the list above.

Convert, power, drive, generate, transfer, increase, reduce, rotate.

1. Electric motors are designed to _____ electrical energy into mechanical energy.
2. Generators _____ mechanical energy into electrical energy in power plants.
3. Transformers _____ voltage levels between circuits for efficient power distribution.
4. In electric vehicles, motors _____ the wheels by providing the necessary torque.
5. High-efficiency electrical machines help to _____ energy consumption and costs.
6. The rotor in an electrical machine begins to _____ when the machine is activated.
7. Transformers can be used to _____ voltage for long-distance power transmission.
8. Electric motors _____ various household appliances like fans and refrigerators.

VI. Choose the appropriate word to fill in the gaps in the sentences below.

1. Electric motors are used to _____ energy into mechanical energy.

a) generate *b) convert* *c) transfer*

2. Generators _____ mechanical energy to produce electricity.

a) convert *b) increase* *c) reduce*

3. Transformers are used to _____ voltage levels for efficient power transmission.

a) power *b) transfer* *c) rotate*

4. The rotor in a motor will _____ when the motor is turned on.

a) convert *b) power* *c) rotate*

5. High-efficiency machines _____ energy losses and save on operational costs.

a) generate *b) reduce* *c) transfer*

6. Electric motors _____ various household appliances, including fans and washing machines.

a) transfer *b) generate* *c) power*

7. A generator helps to _____ electricity from mechanical sources.

a) convert *b) increase* *c) power*

8. Transformers can _____ voltage to ensure that it is suitable for different uses.

a) increase *b) power* *c) reduce*

VII. Translate the following sentences into English.

1. Електродвигуни перетворюють електричну енергію в механічну енергію.

2. Генератори використовують механічну енергію для виробництва електрики.

3. Трансформатори дозволяють змінювати рівень напруги в електричних мережах.

4. Ротор електродвигуна обертається під впливом магнітного поля.

5. Стартер використовується для запуску електродвигуна.

6. Ефективність електричних машин визначає, наскільки добре вони використовують енергію.

7. У промисловості часто використовують двигуни змінного струму для великої потужності.

VIII. Match each sentence half on the left with the correct half on the right.

1. Electric motors convert electrical energy	a. in electrical networks to ensure proper operation.
2. Generators use mechanical energy	b. for starting the motor.
3. Transformers adjust the voltage level	c. into mechanical energy to power various devices.
4. The rotor in a motor rotates	d. under the influence of a magnetic field.
5. A starter is used to	e. to generate electrical energy.
6. The efficiency of electrical machines	f. determines how effectively they convert energy.
7. Alternating current motors are often used	g. in industrial applications requiring high power.

IX. Speaking.

Instructions: Prepare a short spoken presentation on the topic "The Impact of Electrical Machines on Everyday Life and Industry." Use the following prompts to guide your presentation. Aim for about 3-5 minutes, and consider including examples and personal insights to make your presentation engaging.

1. Introduction (30-45 seconds):

– Begin by introducing the topic and explaining what electrical machines are.

– Mention that they play a crucial role in converting energy and are essential in both everyday life and industrial applications.

2. Electric Motors (1 minute):

– Describe how electric motors work and their primary function.

– Provide examples of everyday appliances that use electric motors (e.g., refrigerators, washing machines, and air conditioners).

– Discuss how electric motors are used in various industries (e.g., automotive, manufacturing, and aerospace).

3. Generators (1 minute):

– Explain the function of generators in converting mechanical energy into electrical energy.

– Discuss their role in power generation and distribution.

– Highlight their importance in ensuring a reliable electricity supply for homes and businesses.

4. Transformers (45 seconds - 1 minute):

– Describe the role of transformers in adjusting voltage levels in electrical networks.

– Explain why this is important for efficient power transmission and safe electricity use.

– Provide examples of how transformers are used in the power grid.

5. Efficiency and Technological Advancements (45 seconds – 1 minute):

– Discuss the significance of efficiency in electrical machines.

– Mention how advancements in technology have improved machine performance and reduced energy consumption.

– Talk about the benefits of high-efficiency machines, such as cost savings and environmental impact.

6. Conclusion (30 seconds)

– Summarize the key points of your presentation.

– Emphasize the importance of electrical machines in modern technology and their impact on daily life and industry.

X. Writing.

Write a short essay on the topic “The Role and Importance of Electrical Machines in Modern Technology.” Use the following prompts to guide your writing:

1. Introduction: Begin by explaining what electrical machines are and their general purpose. Mention the two main types of electrical machines: electric motors and generators.

2. Electric Motors: Describe how electric motors work, their applications, and why they are crucial for various devices and industries. Include examples of everyday appliances and industrial equipment that rely on electric motors.

3. Generators: Explain the role of generators in converting mechanical energy into electrical energy. Discuss their importance in

power generation and distribution, and how they support daily life by supplying electricity to homes and businesses.

4. Transformers: Discuss how transformers are used to adjust voltage levels in electrical networks. Highlight their importance in the efficient transmission of electrical power over long distances and their role in ensuring safe electricity use.

5. Efficiency and advancements: reflect on the importance of efficiency in electrical machines and how technological advancements have improved their performance. Mention the benefits of high-efficiency machines in terms of energy consumption and cost savings.

6. Conclusion: Summarize the key points discussed in your essay and emphasize the significance of electrical machines in maintaining and advancing modern technology.

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