**ПМ 2 MECH 1-23**

**Mechatronics Бекзат**

1. What is the primary aim of Mechatronics as a field of engineering?

A) To develop electrical networks for domestic use

B) To isolate mechanical engineering from electronics

C) To integrate mechanical, electrical, and software systems into unified solutions ✅

D) To replace software engineers with mechanical engineers

2. Which component is not typically part of a mechatronic system?

A) Sensors

B) Actuators

C) Legal documentation ✅

D) Microcontrollers

3. What does a control system in mechatronics typically involve?

A) Only mechanical gear ratios

B) Manual intervention

C) Feedback loops and control algorithms ✅

D) Exclusive use of hydraulic energy

4. What is the correct order of the control loop in a mechatronic system?

A) Mechanical part → Actuator → Sensor → Processor

B) Sensor → Information processing → Actuator → Mechanical change ✅

C) Actuator → Processor → Sensor → Mechanical unit

D) Processor → Mechanical change → Sensor → Controller

5. In which industry is Mechatronics least likely to be directly applied?

A) Manufacturing

B) Fine Arts ✅

C) Robotics

D) Automotive

6. Which of these is an example of a mechatronic system in a car?

A) Car paint design

B) Exhaust pipe length

C) Anti-lock Braking System (ABS) ✅

D) Leather seat quality

7. Which of the following programming languages is most relevant for mechatronics engineers?

A) Swift

B) HTML

C) C++ ✅

D) PHP

8. What skill is essential for a mechatronics engineer when designing consumer electronics?

A) Knowledge of criminal law

B) Basic cooking skills

C) Ability to fly drones manually

D) Use of computer-aided design (CAD) software ✅

9. What does the term "integration" refer to in the context of mechatronics?

A) Focusing on just electrical systems

B) Ignoring software to emphasize hardware

C) Combining knowledge from multiple engineering disciplines to create complete systems ✅

D) Merging companies in the technology sector

10. What is one major advantage of applying mechatronics in manufacturing industries?

A) Reduces the need for any supervision

B) Makes manual labor more dangerous

C) Improves efficiency and automation of production systems ✅

D) Eliminates the need for mechanical components

**Output/Input signals Султан Т.**

1. Which one is an input signal for a mechatronic system?

A) A motor turning

B) A button being pressed ✅

C) A light turning on

D) A light turning off

2. What is an example of an analog signal?

A) ON/OFF signal from a switch

B) A number between 0 and 5 volts ✅

C) A signal that is always 5 volts

D) A flashing light

3. What do we use to change an analog signal into a digital one

A) Light sensor

B) Battery

C) ADC (Analog to Digital Converter) ✅

D) Motor driver

4. Which device gives changing values as input?

A) Button

B) Motor

C) Light switch

D) Temperature sensor ✅

5. Which of these is an input device in a system?

A) Light bulb

B) Speaker

C) Temperature sensor ✅

D) Motor

6. What is an example of a digital output?

A) Speed control

B) Turning an LED on or off ✅

C) Adjusting brightness

D) Changing temperature

7. Which device gives a simple ON or OFF signal to a system?

A) A thermometer measuring temperature

B) A button that can only be pressed or released ✅

C) A sensor that measures motor speed

D) A volume knob for different levels

8. Which of these is an output device in a mechatronic system?

A) A button used to send input commands

B) A temperature sensor that measures heat

C) A light bulb for turning on to show a clear and visible signal✅

D) A thermometer that measures room temperature

9. Which signal can change smoothly, not just ON or OFF?

A) A digital signal that is either ON or OFF only

B) A signal from an ON/OFF switch that gives two values

C) An analog signal that can change to many different levels ✅

D) A button press that is either pressed or not pressed

10. Which action is done by an output in a system?

A) Pressing a switch to send a command

B) Reading a sensor to get information

C) Starting a motor for performing work ✅

D) Checking the temperature

**Analog and Digital signals Бакдаулет**

1. Which of the following is an analog signal?

A) ON/OFF button signal

B) Output from an encoder

C) Temperature reading from a thermistor ✅

D) Digital microcontroller output

2. The main difference between analog and digital signals is:

A) Signal amplitude can vary in certain conditions

B) Ability to transmit over Wi-Fi using modules

C) Continuity of values over time without discrete steps ✅

D) Use of resistors and capacitors in circuits

3. Which of the following is an example of a digital signal?

A) Voltage change

B) Output of temperature sensor

C) Microphone audio signal

D) Keystroke signal from a keyboard ✅

4. Which waveform best represents an analog signal?

A) Step waveform

B) Discrete pulse

C) Smooth sine wave ✅

D) Square wave

5. What happens during analog-to-digital conversion (ADC)?

A) Voltage increases

B) Sinusoidal wave is generated

C) Continuous signal is converted into digital form ✅

D) Noise is removed from the signal

6. Which of the following devices commonly works with analog signals?

A) Relay used to switch electrical circuits

B) Microprocessor processes data and instructions

C) Potentiometer for adjusting voltage manually in analog circuits ✅

D) LED emits light when powered by current

7. What does "discrete signal" mean?

A) Noise-free signal

B) Signal with variable amplitude

C) Signal made up of distinct individual values ✅

D) Time-amplified waveform

8. One disadvantage of analog signals is:

A) They cannot be measured

B) They are always more accurate

C) They are more prone to noise and distortion ✅

D) They require less hardware

9. What is the purpose of a Digital-to-Analog Converter (DAC)?

A) To filter the signal

B) To transmit data wirelessly

C) To convert digital data into a usable analog signal ✅

D) To measure environmental conditions

10. Which type of signal is better suited for long-distance transmission and storage?

A) Analog signal used in old audio systems

B) Noisy signal with distortion levels

C) Digital signal because it is less affected by interference and can be stored efficiently ✅

D) Visual signal as images used for communication

**Op-Amp Нурдаулет**

1. What is the primary function of a voltage follower in op-amp circuits?

A) To amplify the input signal

B) To invert the input signal

C) To provide unity gain with high input impedance and low output impedance ✅

D) To reduce the bandwidth of the signal

2. In an ideal op-amp, what is the value of the common-mode gain?

A) Infinite

B) Zero ✅

C) Equal to differential gain

D) Unpredictable

3. Which configuration of an op-amp is typically used to perform mathematical integration of the input signal?

A) Differentiator

B) Inverting amplifier

C) Integrator ✅

D) Voltage follower

4. What is the effect of negative feedback on the bandwidth of an op-amp?

A) Causing error

B) Increases bandwidth ✅

C) Has no effect

D) Causes instability

5. In a non-inverting amplifier configuration, how is the voltage gain determined?

A) By the ratio of input to feedback resistance

B) By the open-loop gain of the op-amp

C) By the ratio of feedback to input resistance plus one ✅

D) It is always unity

6. What is the typical input impedance of an ideal op-amp?

A) Zero

B) Low

C) High

D) Infinite ✅

7. Which parameter defines the op-amp’s ability to reject common-mode signals?

A) Slew rate

B) Bandwidth

C) Common-mode rejection ratio ✅

D) Input offset voltage

8. What happens to the output of an op-amp when both inputs are at the same voltage?

A) Output equals positive supply voltage

B) Output equals negative supply voltage

C) Output is zero ✅

D) Output is unpredictable

9. Which of the following best describes the slew rate of an op-amp?

A) The rate at which the input voltage changes

B) The maximum rate of change of the output voltage ✅

C) The rate of change of the input current

D) The frequency response of the op-amp

10. What is the open-loop gain of an ideal operational amplifier?

A) Zero

B) One

C) Infinite ✅

D) Undefined

**Analog Electronics Аяжан**

1. What is an analog signal?

A) A signal that has only two levels

B) A continuous signal that varies over time ✅

C) A signal transmitted via optical fiber

D) Noise in an electrical circuit

2. In which direction does a regular silicon diode conduct current?

A) In both directions

B) Only from cathode to anode

C) From anode to cathode when forward-biase ✅

D) Only with AC current

3. What is an operational amplifier (op-amp)?

A) A special type of transistor

B) A high-gain amplifier with inverting and non-inverting inputs ✅

C) A DC power supply

D) A relay with amplification capability

4. What distinguishes an NPN transistor from a PNP transistor?

A) NPN has positive base voltage, PNP has negative

B) They have different package shapes

C) NPN conducts when the base is positive relative to the emitter ✅

D) PNP has no collector terminal

5. What is the purpose of a capacitor in an analog circuit?

A) To amplify the input signal

B) To generate a clock signal

C) To store and release electrical energy ✅

D) To convert AC to DC

6. What does a low-pass RC filter do?

A) Amplifies high frequencies

B) Passes low frequencies and attenuates high ones ✅

C) Converts AC to DC

D) Measures signal amplitude

7. What is the function of a Zener diode in a circuit?

A) Amplifies AC signals

B) Works at high temperatures

C) Regulates voltage at a fixed level ✅

D) Works like a fuse

8. What is transistor biasing?

A) Switching the transistor in digital mode

B) Setting up the transistor to operate in the desired region ✅

C) Measuring signal power

D) Cooling the transistor

9. What is the main function of a resistor in an analog circuit?

A) To amplify voltage

B) To limit current flow ✅

C) To store energy

D) AC to DC

10. Which parameter is most important when selecting an op-amp?

A) Color of the package

B) Gain and input impedance ✅

C) Lead length

D) Battery type

**1st Kirchhoff’s Law Мустафа**

1. Consider the following two statements:

(A) Kirchhoff's junction law follows from the conservation of charge.

(B) Kirchhoff's loop law follows from the conservation of energy.

Which of the following is correct?

A) None are correct

B) A is correct

C) B is correct

D) Both A and B are correct ✅️

2. Kirchhoff’s first law ∑i =0 and second law ∑iR = ∑E are based on which physical principles?

A) Conservation of charge and conservation of energy ✅️

B) Conservation of charge, conservation of momentum

C) Conservation of energy, conservation of charge

D) Conservation of momentum, conservation of charge

3. Which of the following is Kirchhoff’s first law?

A) KCL ✅️

B) KVL

C) Current law

D) Both A and C

4. Which Kirchhoff’s law defines that the sum of incoming and outgoing currents at a node are equal?

A) KCL ✅️

B) KVL

C) Voltage law

D) Both B and C

5. Which formula represents KCL when are incoming and are outgoing currents at a node?

A) i1+i2=i3+i4 ✅️

B) i1•i2=i3+i4

C) i1+i2=i3•i4

D) i1•i2=i3•i4

6. Who introduced Kirchhoff’s current law (KCL)?

A) Gustav Kirchhoff ✅️

B) Henry

C) Charles Daniel

D) Both B and C

7. Which of the following electric parameters can be calculated using Kirchhoff’s laws?

A) Voltage

B) Resistance

C) Current

D) Both A and C ✅️

8. What is an application of Kirchhoff’s laws?

A) Determine current in a circuit

B) Determine potential drop

C) Determine current direction

D) For determining all of the above ✅️

9. Which law is used for analyzing electrical circuits?

A) Kirchhoff’s law ✅️

B) Newton’s law

C) Faraday’s law

D) Ohm’s law

10. KCL is applied to which types of networks?

A) Non-planar networks

B) Planar networks

C) Both A and B ✅️

D) Node networks

**2nd Kirchhoff’s Law Аманбек**

1. What is the core principle of Kirchhoff’s Second Law in a closed circuit loop?

A) Total current in equals total current out

B) Sum of all voltages around the loop equals zero ✅

C) Total resistance is constant

D) Power input equals power output

2. A single loop has a 12 V battery and two resistors with voltage drops of 3 V and 5 V. What is the voltage drop across a third resistor in the loop?

A) 2 V

B) 4 V ✅

C) 6 V

D) 1 V

3. In a circuit loop with a 20 V EMF, two resistors cause voltage drops of 8 V and 7 V. Using ∑V = 0, what is the voltage drop across the remaining resistor?

A) 5 V ✅

B) 3 V

C) 4 V

D) 2 V

4. A 15 V battery powers a loop with resistors dropping 6 V and 4 V. What’s the voltage drop across the final resistor?

A) 3 V

B) 5 V ✅

C) 2 V

D) 4 V

5. How is a voltage drop across a resistor determined when applying KVL?

A) V = I / R

B) V = I \* R ✅

C) V = P / I

D) V = R / I

6. A loop contains two EMFs (E₁ = 12 V, E₂ = 8 V) and resistors with drops of 9 V and 6 V. Using ∑E = ∑V, what’s the net voltage?

A) 5 V

B) 0 V ✅

C) 3 V

D) 2 V

7. Why does Kirchhoff’s Second Law hold true in circuits?

A) It balances current flow

B) It reflects conservation of energy ✅

C) It calculates power loss

D) It measures resistance

8. A 30 V battery powers a loop with resistors dropping 15 V and 8 V. What’s the remaining voltage drop?

A) 7 V ✅

B) 5 V

C) 9 V

D) 8 V

9. In a loop with a 25 V EMF and voltage drops of 10 V, 6 V, and an unknown Vₓ, what is Vₓ per Kirchhoff’s Voltage Law?

A) 8 V

B) 9 V ✅

C) 7 V

D) 10 V

10. How are voltage polarities handled in Kirchhoff’s Second Law?

A) Voltage drops are positive, rises are negative

B) Voltage rises (EMF) are positive, drops are negative ✅

C) All voltages are treated as positive

D) Voltage direction does not matter

**Battery Уалитхан**

1. What is the main chemical element used in standard alkaline batteries?

A) A caustic solution of potassium hydroxide as main electrolyte

B) An organic compound with electrochemical properties

C) A combination of rare earth metals used for conductivity

D) Zinc, which serves as the primary anode material in most designs ✅

2. Which battery type is most commonly found in modern smartphones?

A) Rechargeable nickel-metal hydride battery technology

B) A sealed lead-acid battery unit for mobile applications

C) High-capacity lithium polymer battery for flat design

D) Lithium-based battery cells with enhanced energy density ✅

3. Which unit is typically used to indicate electrical potential?

A) Electrical energy measured in kilowatt-hours over time

B) Total charge stored in ampere-hours per discharge cycle

C) Potential difference typically measured in volts

D) Volt, the standard unit for electrical potential difference ✅

4. What can happen to a battery if it is deeply discharged?

A) It might experience irreversible internal damage

B) The system will enter a forced protection

C) The cell chemistry may lose rechargeability

D) Drop in overall performance and ability to hold a charge ✅

5. Which metal is a key material in electric vehicle batteries?

A) A stable configuration of refined manganese alloys

B) High-grade processed cobalt compound materials

C) A blend of recyclable metals, nickel elements

D) Lithium, used for its lightweight and high charge density ✅

6. Which of the following batteries is not designed to be recharged?

A) A modern high-density lithium-ion battery pack

B) A reusable nickel-cadmium cylindrical battery cell

C) Sealed maintenance-free lead-acid battery technology

D) Alkaline cells designed for single-use disposable operation ✅

7. What particle actually moves to generate electrical current in a battery?

A) Charged particles commonly known as electrons

B) Positively and negatively charged ions in motion

C) Moving particles that interact inside the electrolyte

D) Ions and electrons that enable current flow in the circuit ✅

8. Which unit is most commonly used to measure battery capacity?

A) Stored electrical energy in watt-seconds or joules

B) A measure of voltage multiplied by current output

C) Energy content represented in kilojoules per volume

D) Ampere-hours, which indicate how much charge a battery can deliver ✅

9. What external factor is most likely to reduce battery lifespan?

A) Repeated exposure to long-term overcharging conditions

B) Operating conditions that exceed design limits

C) Consistent full-cycle discharging and max recharging

D) Heat, especially prolonged high temperatures during the using process ✅

10. What is a common name for batteries that can be charged again?

A) Rechargeable electrochemical storage battery unit

B) Environmentally friendly power source with reuse cycle

C) Multi-use battery type with reversible internal reaction

D) Accumulator, which allows repeated charge-discharge cycles ✅

**Capacitors Темирхан**

1. What is the unit of capacitance?

A) Ohm

B) Watt

C) Farad ✅

D) Ampere

2. Which component stores electrical energy in an electric field?

A) Capacitor ✅

B) Resistor

C) Inductor

D) Transformer

3. What happens to the capacitance if the area of the capacitor plates increases?

A) Capacitance decreases

B) Capacitance starting to increase ✅

C) Capacitance stays the same

D) Capacitance becomes zero

4. Which factor does NOT affect the capacitance of a parallel-plate capacitor?

A) Distance between plates

B) Resistance of the plates ✅

C) Area of the plates

D) Dielectric material

5. What is the symbol for capacitance in formulas?

A) R

B) L

C) C ✅

D) Q

6. What is the function of a capacitor in a DC power supply filter?

A) Amplify the voltage

B) Increase current

C) Smooth the output voltage ✅

D) Convert AC to DC

7. What is the equivalent capacitance of two capacitors in series: 6 µF and 3 µF?

A) 9 µF

B) 4.5 µF

C) 2 µF ✅

D) 1 µF

8. A capacitor is charged to 12 V and stores 0.36 J of energy. What is its capacitance?

A) 0.1 µF

B) 0.5 µF

C) 5 µF ✅

D) 0.7 µF

9. What is the time constant (τ) of an RC circuit with R = 10 kΩ and C = 100 µF?

A) 1 s

B) 1 second ✅

C) 0.1 s

D) 10 s

10. In an AC circuit, a capacitor causes the current to:

A) Lag voltage

B) Be in phase

C) Lead the voltage ✅

D) Stop process

**Electrical Resonance Мадина**

1. What is electrical resonance?

A) A type of battery

B) A kind of resistor

C) A condition in a circuit when inductive and capacitive reactances are equal ✅

D) A method for increasing the resistance in AC circuits

2. In which type of circuits does electrical resonance occur?

A) DC circuits

B) LED circuits

C) AC circuits with inductors and capacitors✅

D) Circuits with only resistors, batteries

3. What happens to the current at resonance in an RLC series circuit?

A) It becomes zero

B) It becomes infinite in ideal case due to minimum impedance ✅

C) It becomes equal to voltage

D) It stops flowing

4. What is the resonant frequency formula for an RLC circuit?

A) R \* C

B) L \* R

С) 2π \* LC

D) 1 / (2π√(LC)) ✅

5. What is the effect of resonance on impedance in a series RLC circuit?

A) Impedance is maximum

B) Impedance becomes infinity

C) Impedance is minimum and equals resistance only ✅

D) Impedance cancels out completely

6. What happens to the voltage across L and C at resonance?

A) Both are zero

В) Both are high and equal in magnitude but opposite in phase ✅

С) Both become equal and cancel each other

D) Both increase but do not affect current

7. What type of response is observed at resonance in a parallel RLC circuit?

A) Current is lowest

B) Voltage drops quickly

C) Current is high due to very low admittance ✅

D) Power increases slowly

8. What causes resonance in an RLC circuit?

А) Equal magnitude of inductive and capacitive reactance ✅

B) High resistance

C) Large wires

D) Low resistance

9. Which one is a real-world application of electrical resonance?

A) LED blinking

B) Power supply switching

C) Tuning radios to a specific frequency ✅

D) Heating of wires

10. What is the quality factor (Q factor) in resonance?

A) A resistor’s rating

B) A power loss factor

C) A way to increase capacitance

D) A measure of sharpness of resonance or energy stored vs. lost ✅

**Diodes Вадим**

1. What is the basic control mode of a diode?

A) Signal amplification

B) Voltage conversion

C) Current flow in only one direction ✅

D) Charge storage

2. What type of diode is used to maintain voltage?

A) Zener diode ✅

B) Schottky

C) LED

D) Varicap

3. Which diode emits light when current flows?

A) Varicap

B) Zener diode

C) LED (Light Emitting Diode)✅

D) Schottky

4. Which device necessarily uses diodes?

A) Transformer

B) AC Rectifier ✅

C) Capacitor

D) Resistor

5. What happens if you connect a diode "in reverse"?

A) It will turn on

B) It will not conduct current ✅

C) It will charge

D) It will amplify the signal

6. What is the purpose of a rectifier?

A) Reduces current

B) Makes current alternating

C) Converts alternating current to direct current ✅

D) It charges the diode

7. Which diode turns on the light?

A) Schottky

B) Zener

C) Photodiode ✅

D) Varicap

8. How many leads (legs) does a diode usually have?

A) 1

B) 2 ✅

C) 3

D) 4

9. What is the negative side of a diode called?

A) Central

B) Cathode ✅

C) Electrode

D) Ground

10. Which part of a diode is called the anode?

A) Electrode

B) Positive Side ✅

C) Central part

D) Ground

**Ohm’s Law Шерхан**

1. What does Ohm’s Law describe?

A) How fast current flows

B) The speed of electricity

C) The behavior of insulators

D) The relationship between voltage, current, and resistance in a circuit ✅

2. What is the formula for Ohm’s Law?

A) P = I / V

B) W = F / d

C) F = m / a

D) V = I \* R ✅

3. In Ohm’s Law, what does the symbol “I” represent?

A) Isolation

B) Input

C) Ionization

D) Electric current ✅

4. If the voltage across a resistor increases and the resistance stays the same, what happens to the current?

A) It stays the same

B) It decreases

C) It turns off

D) The current increases ✅

5. What happens to the current if the resistance increases but the voltage stays the same?

A) It stays the same

B) It increases

C) It disappears

D) The current decreases ✅

6. What are the standard units used in Ohm’s Law?

A) Newtons, Joules, Watts

B) Grams, Seconds, Liters

C) Meters, Volts, Grams

D) Volts for voltage, Amperes ✅

7. A circuit has a voltage of 12V and resistance of 4Ω. What is the current?

A) 1 A

B) 2 A

C) 6 A

D) 3 A ✅

8. Which condition would violate Ohm’s Law?

A) Constant temperature

B) Linear relationship between V and I

C) Resistance remains the same

D) Components whose resistance changes with voltage ✅

9. What does a higher resistance in a circuit do to the current, assuming voltage stays the same?

A) Makes it stronger

B) Has no effect

C) Speeds it up

D) Reduces the current ✅

10. Which component in a circuit most directly provides resistance?

A) Battery

B) Switch

C) Capacitor

D) Resistor ✅

**ADC DAC Абай**

1. What is the main function of an ADC?

A) Converts digital to analog

B) Converts analog to digital signals for digital processing ✅

C) Stores analog signals

D) Measures voltage directly

2. What is the purpose of a DAC?

A) Converts digital values back into smooth, continuous analog signals ✅

B) Measures analog voltage

C) Filters digital signals

D) Stores data

3. Which factor determines the resolution of an ADC?

A) Speed

B) Number of bits, which defines voltage range ✅

C) Voltage supply

D) Temperature

4. What is quantization error in ADC?

A) Error due to software bugs

B) Small difference between the outputs✅

C) Signal noise

D) Circuit overheating

5. What is the Nyquist rate?

A) Half of the sampling frequency ✅

B) Maximum voltage

C) Clock speed

D) Minimum current

6. What does “sampling” mean in ADC?

A) Applying a voltage

B) Taking discrete measurements ✅

C) Running code

D) Storing memory

7. What is a common application of a DAC?

A) Converting stored digital into analog ✅

B) Measuring light intensity

C) Calculating resistance

D) Storing digital files

8. How does increasing the bit depth of an ADC affect performance?

A) Reduces power

B) Increases resolution and reduces quantization error ✅

C) Increases noise

D) Lowers frequency

9. Why is anti-aliasing filtering used before ADC?

A) To remove high-frequency ✅

B) To heat the circuit

C) To reduce clock speed

D) To increase voltage

10. What is a major limitation of a low-resolution DAC?

A) Creates smooth signals

B) Produces noticeable steps or jaggedness ✅

C) Increases frequency

D) Improves accuracy

**Kotelnikov’s Theorem Султан А.**

1. What is the purpose of Kotelnikov’s Theorem?

A) To measure voltage values in analog systems

B) To analyze the behavior of resistive circuits

C) To convert continuous signals into a series of digital samples ✅

D) To store data in digital memory cells

2. Kotelnikov’s Theorem states that a signal can be fully restored if:

A) The frequency is measured with accurate instruments

B) The signal is periodic and sinusoidal in nature

C) The sampling rate is at least twice the maximum frequency in the signal ✅

D) It is filtered with a low-pass hardware filter

3. The minimum required sampling frequency is called:

A) The harmonic base for the wave function

B) Fundamental analog conversion rate

C) The Nyquist frequency, which is twice the highest frequency ✅

D) The signal’s spectral division value

4. If the sampling frequency is too low, the result is:

A) An increase in resolution and data accuracy

B) A complete loss of low-frequency information

C) Aliasing, which causes distortion and spectral overlap ✅

D) A reduction of unwanted frequency components

5. The Kotelnikov interpolation formula is based on:

A) A summation of cosine signals in time domain

B) Linear approximation using difference equations

C) A series of sinc functions that are centered at sample points ✅

D) Fourier transform using complex frequency bands

6. The ideal reconstruction of the signal uses the function:

A) delta(t), the Dirac impulse function

B) sin(t), to match the analog wave shape

C) sinc(t), which defines the perfect interpolation curve ✅

D) step(t), to follow the input signal pattern

7. Kotelnikov’s Theorem is closely related to:

A) Gauss's Law from classical physics

B) Euler’s identity in complex numbers

C) Shannon’s Sampling Theorem from information theory ✅

D) Lagrange’s theorem in mathematics

8. For a signal with maximum frequency of 10 kHz, the sampling rate should be at least:

A) 5 Hz, to reduce the signal size efficiently

B) 10 Hz, matching the signal frequency exactly

C) 20 kHz, which ensures accurate reconstruction ✅

D) 50 Hz, for extremely high precision sampling

9. Signals that satisfy Kotelnikov’s Theorem must be:

A) Completely random, unfiltered in shape

B) Perfectly periodic with harmonic content

C) Band-limited to a known maximum frequency ✅

D) Discrete signals with infinite resolution

10. The main idea behind the theorem is that:

A) Sampling removes the need for analog filtering

B) Digital signals can be stored without compression

C) Analog signals can be reconstructed perfectly if sampled correctly ✅

D) All physical signals are already digital in nature

**Resistors Айбат**

1. What is the primary function of a resistor in an electrical circuit?

A) To store electrical energy

B) To increase voltage

C) To limit or control the flow of electric ✅

D) To amplify signals

2. What does the color code on a resistor indicate?

A) Its power rating

B) Its resistance value and tolerance ✅

C) Its voltage rating

D) Its temperature coefficient

3. How is the total resistance calculated in a series circuit with multiple resistors?

A) It is the average of all resistances

B) It is the product of all resistances

C) It is the sum of the individual resistances ✅

D) It is the inverse of the sum of the resistances

4. What is Ohm’s Law as it relates to resistors?

A) Power equals voltage times current

B) Resistance equals current divided by voltage

C) Voltage across a resistor equals the product of its resistance ✅

D) Resistance equals power divided by current

5. What happens to the total resistance in a parallel circuit with multiple resistors?

A) It equals the sum of the resistances

B) It is greater than the largest individual resistance

C) It is less than the smallest individual resistance, calculated using the reciprocal formula ✅

D) It is the average of the resistances

6. What is the unit of measurement for resistance?

A) Ampere

B) Volt

C) Ohm ✅

D) Watt

7. What is a variable resistor commonly used for?

A) To store charge

B) To adjust circuit parameters like volume or brightness ✅

C) To amplify current

D) To convert AC to DC

8. What is the power rating of a resistor?

A) The voltage it can withstand

B) The maximum amount of power it can dissipate ✅

C) The current it produces

D) The resistance it provides

9. What type of resistor is commonly used in high-precision applications?

A) Carbon composition resistor

B) Wire-wound resistor

C) Metal film resistor, known for its accuracy ✅

D) Variable resistor

10. What happens to a resistor’s performance if it is operated beyond its power rating?

A) It becomes more efficient

B) It may overheat, burn out, or become damaged ✅

C) It increases its resistance

D) It reduces its voltage

**Connection types of Resistors Наргиз**

1. What is the total resistance of resistors connected in series?

A) Product of all resistances

B) Same as the smallest resistor

C) Sum of all resistances ✅

D) Zero

2. In a parallel connection, the voltage across each resistor is:

A) Different

B) Zero

C) Stays the same ✅

D) Sum

3. Which formula is used to calculate total resistance in a parallel connection?

A) R = R1 + R2

B) V = IR

C) 1/R= 1/R1 +1/R2✅

D) R = R1 \* R2

4. What happens to total resistance when more resistors are added in parallel?

A) Increases

B) It decreases ✅

C) The same

D) Zero

5. Which connection allows the same current through all resistors?

A) Parallel

B) Open circuit

C) Series connection ✅

D) Short circuit

6. In which connection does the total resistance become less than the smallest resistor?

A) Series

B) Parallel ✅

C) Mixed

D) None

7. If three resistors of 2Ω, 4Ω, and 6Ω are connected in series, total resistance is:

A) 4Ω

B) 6Ω

C) 12Ω ✅

D) 2Ω

8. If three 6Ω resistors are connected in series, total resistance is:

A) 2Ω ✅

B) 18Ω

C) 6Ω

D) 3Ω

9. What is a series-parallel connection?

A) All resistors in one line

B) All resistors across same two points

C) Combination of both series and parallel ✅

D) Only one resistor used

10. Which connection type is used to reduce total resistance in a circuit?

A) Series

B) Parallel ✅

C) Open

D) None

**Connection types of Capacitance Аружан**

1. What happens to total capacitance when capacitors are connected in series?

A) It increases as all capacitances are added

B) It decreases and is always less than the smallest capacitance ✅

C) It remains unchanged if all capacitors are equal

D) It becomes equal to the average of all capacitances

2. In a parallel connection of capacitors, the total capacitance is:

A) Equal to the value of the largest capacitor

B) Calculated as the all capacitances

C) Equal to the sum of all connected capacitance ✅

D) Divided by the number of capacitors

3. Which formula is correct for total capacitance in series (for two capacitors)?

A) C = C₁ + C₂

B) 1/C = 1/C₁ + 1/C₂ ✅

C) C = C₁ × C₂

D) C = (C₁ + C₂)/2

4. Which formula applies to total capacitance in parallel?

A) 1/C = 1/C₁ + 1/C₂

B) C = C₁ + C₂ + C₃ + … ✅

C) C = (C₁ × C₂)/(C₁ + C₂)

D) C = C₁ − C₂

5. What is the total capacitance of three 10 μF capacitors connected in parallel?

A) 10 μF

B) 20 μF

C) 30 μF ✅

D) 5 μF

6. What happens to voltage rating when capacitors are connected in series?

A) It decreases, especially if values differ

B) It increases as voltage is divided among capacitors ✅

C) It stays the same as for a single capacitor

D) It depends only on the first capacitor

7. In which type of connection does each capacitor have the same voltage across it?

A) Series

B) Parallel ✅

C) Mixed

D) None

8. In which connection type is the charge (Q) the same on all capacitors?

A) In series ✅

B) Parallel

C) Mixed

D) Never

9. What happens to stored energy when capacitors are added in parallel?

A) It decreases as voltage drops

B) It increases due to higher total capacitance ✅

C) It stays constant

D) It depends only on the power source

10. Which type of connection is typically used to increase total capacitance?

A) Series

B) Parallel connection ✅

C) Mixed

D) Grounded

**Branch Туремурат**

1. In circuit analysis, how are branches and nodes related?

A) Branches connect nodes ✅

B) Nodes are branches

C) Nodes store charge

D) Branches store voltage

2. Which of the following components can be part of a branch in a circuit?

A) Only batteries

B) Only resistors

C) Any passive or active element ✅

D) Only inductors

3. What do we call the point where two or more branches meet in a circuit?

A) Loop

B) Terminal

C) Junction (node) ✅

D) Resistance

4. In which type of circuit are branches commonly found?

A) Only in series circuits

B) Only in simple circuits

C) In high- voltage circuits

D) In parallel or complex circuits ✅

5. When analyzing a circuit with branches, what is the main goal of applying Kirchhoff’s Current Law (KCL)?

A) To find voltage drops

B) To calculate power

C) To determine current at junctions ✅

D) To measure resistance

6. In an electrical circuit, what is a branch?

A) A connection of multiple power

B) A closed loop in the circuit

C) A single path connecting two nodes ✅

D) A point where current is zero

7. In a parallel circuit, how are the branches connected?

A) In series with each other

B) Directly across the same two nodes ✅

C) At random intervals

D) Only through inductors

8. If a parallel circuit has three branches, what can we say about the voltage across each branch?

A) It depends on the resistance

B) It is different for each branch

C) It is the same across all branches ✅

D) It is zero in one branch

9. In a series circuit, how many branches are there usually?

A) Zero

B) Only a single one ✅

C) Multiple ones

D) Two or more

10. If two branches in parallel each carry 2 A of current, what is the total current entering the parallel network?

A) 1 A

B) 2 A

C) 4 A ✅

D) 0 A

**AC and DC Расул**

1. What is the primary difference between DC and AC currents?  
A) DC changes direction while AC flows in one direction  
B) DC has a high voltage, AC has a low voltage  
C) DC flows in one direction; AC changes direction periodically ✅  
D) DC is used in homes; AC is used in batteries  
  
2. What is the shape of an ideal AC waveform?  
A) Square  
B) Triangle  
C) Pulse  
D) Sine wave ✅  
  
3. In an AC power system, what does the frequency indicate?  
A) The total voltage  
B) The number of times current changes direction per second ✅  
C) The amount of energy used  
D) The resistance of the circuit  
  
4. What is the typical frequency of AC current in Europe?  
A) 50 Hz only  
B) 60 Hz only  
C) 50 Hz or 60 Hz depending on the country ✅  
D) 100 Hz everywhere  
5. Why is AC power commonly used for power transmission over long distances?  
A) It is easier to generate  
B) It can be stored more easily  
C) It can be easily increased or decreased using transformers ✅  
D) It is safer than DC  
  
6. Which of the following statements is true about DC?  
A) Reverses polarity frequently  
B) Can’t power electronic devices  
C) DC voltage provides a constant value of voltage ✅  
D) More dangerous than AC at all voltages  
  
7. Which component is frequently utilized to store energy in a DC circuit?  
A) Transformer  
B) Capacitor ✅  
C) Inductor  
D) Diode  
  
8. What is the typical waveform of an alternating current (DC)?  
A) None of them at all ✅  
B) Sine wave  
C) Triangle wave  
D) Square wave  
  
9. Which device commonly uses DC power?  
A) Household refrigerator  
B) Electric kettle  
C) Air conditioner  
D) Battery-powered devices ✅  
  
10. Identify which of the following options is not a typical source of DC current?  
A) Battery

B) Solar panel  
C) AC wall outlet ✅  
D) DC generator

**Parameter Waves Мирас**

1. What does the amplitude of a wave tell us?

A) Its speed

B) How high the wave jumps

C) The distance it covers

D) How much energy the wave carries, based on the height ✅

2. If the frequency of a wave increases, what happens to the wavelength (if speed stays the same)?

A) It stays the same

B) It becomes infinite

C) It gets shorter, when speed is constant ✅

D) It gets louder

3. What is wavelength?

A) The height of the wave

B) The time it takes for one wave

C) The distance between matching points on a wave ✅

D) The direction the wave moves

4. Why does a wave with a higher amplitude sound louder?

A) It has more speed

B) Because bigger amplitude means more energy ✅

C) It is closer to the speaker

D) The frequency is lower

5. Which best describes frequency in waves?

A) How many wave cycles pass in one second ✅

B) How far the wave goes

C) How tall the wave is

D) How strong the wave feels

6. What is the wave speed formula?

A) Speed = Amplitude ÷ Time

B) Speed = Energy ÷ Time

C) Speed = Frequency × Wavelength ✅

D) Speed = Distance ÷ Amplitude

7. How does the medium affect wave speed?

A) Wave speed changes with the medium’s properties ✅

B) The medium doesn’t matter

C) All waves travel faster in air

D) Light always travels slower in water

8. Which part of a wave is measured to find amplitude?

A) Side to side length

B) From the middle (rest position) to the crest or trough ✅

C) Time between waves

D) From start to finish of the wave

9. What kind of waves are sound waves?

A) Light waves

B) Longitudinal Waves ✅

C) Transverse waves

D) Microwave waves

10. What does it mean if two waves are “in phase”?

A) They are the same color

B) Their crests and troughs match up ✅

C) They are both quiet

D) They cancel each other out

**Fourier Transformation Аида**

1. What is the purpose of the Fourier Transform?

A) To compress a file

B) To sort data

C) To translate text

D) To analyze the frequency components in a signal ✅

2. What type of signal can the Fourier Transform analyze?

A) Only sound

B) Only light

C) Only text

D) Any periodic or approximated signal ✅

3. What does the Fourier spectrum show?

A) Colors

B) Time phase

C) Space

D) Amplitudes and frequencies of the signal ✅

4. What is the fast computation method of the Fourier Transform called?

A) DCT

B) QR

C) CNN

D) Fast Fourier Transform (FFT) ✅

5. What is an amplitude spectrum?

A) Phase graph

B) Noise level

C) Light intensity

D) A representation of signal strength at each frequency ✅

6. What do you get from the inverse Fourier Transform?

A) Noise

B) An image

C) A spectrum

D) A time-domain signal reconstructed from frequency data ✅

7. Which mathematical tool underlies the Fourier Transform?

A) Logarithm

B) Matrices

C) Derivatives

D) An integral over an infinite interval ✅

8. What happens to high-frequency components when a signal is smoothed?

A) They increase

B) They stay the same

C) They shift

D) They are reduced or filtered out ✅

9. Which transform is used for digital signals?

A) Analog

B) Linear

C) Continuous

D) Discrete Fourier Transform (DFT) ✅

10. What phenomenon can be studied using the Fourier spectrum?

A) Plant growth

B) Air temperature

C) Sugar level

D) The frequency content of a complex signal✅

**Voltage Divider Саят**

1. What is the primary function of a voltage divider?

A) Increases the circuit current

B) Multiplies total resistance value

C) Stores charge in the circuit

D) Divides input voltage using resistor ratio ✅

2. What components make a voltage divider?

A) Only capacitor components used

B) Two resistors connected in series form divider ✅

C) Uses basic inductor parts

D) Built with transistor units

3. What is the voltage divider formula?

A) Vout = Vin / R1

B) Vout = R2 / Vin

C) Vout = Vin × R2 / (R1 + R2) ✅

D) Vout = Vin / (R1 + R2)

4. If R2 ≪ R1, what happens?

A) Output voltage becomes very small portion ✅

B) Output stays the same

C) Voltage increases across output

D) Output equals full input

5. Where is it commonly used?

A) In digital converter systems

B) Sensor and signal level conditioning circuits ✅

C) Power lines and grids

D) Oscillator and timer modules

6. Why not for high current?

A) Causes voltage to rise

B) Cannot handle power without overheating resistors ✅

C) Wastes a lot of energy

D) Produces unwanted alternating current

7. Low resistance load effect?

A) Output stays more stable

B) Voltage increases slightly more

C) Has almost no effect

D) Greatly reduces output voltage from divider ✅

8. Ideal load condition for accuracy?

A) Load uses large current

B) R2 must be infinite

C) Load resistance must be much higher than R2 ✅

D) Make R1 resistance zero

9. Temperature effect on resistors?

A) Lowers resistance always

B) No effect is observed

C) Affects only capacitor behavior

D) Resistance may change and affect voltage ✅

10. R1 = 1kΩ, R2 = 2kΩ, Vin = 9V. Vout?

A) Output equals 4 volts

B) Output is 3 volts

C) Output voltage is exactly 6 volts ✅

D) Output shows 5 volts

**Electromotive Force Надежда**

1.What is EMF?

A) EMF is a source of electrical energy that provides a potential difference ✅

B) EMF is resistance to current in a conductor

C) EMF is the amount of electricity flowing

D) EMF is an electromagnetic wave traveling

2. What are some examples of devices that generate EMF?

A) Headphones

B) Incandescent light bulb

C) Fan

D) Batteries, generators, solar cells, and thermocouples ✅

3. Which of these best describes how a battery creates EMF?

A) It converts chemical energy into electrical energy ✅

B) It stores current and releases it instantly

C) It amplifies the voltage of any input

D) It blocks current until a switch is closed

4. Which factor most directly affects the magnitude of EMF generated by a moving conductor in a magnetic field?

A) The speed of motion, strength of the magnetic field ✅

B) The color of the conductor

C) The material of nearby insulation

D) The humidity of the air

5. What does Faraday’s Law state about EMF?

A) It states that the induced EMF in a closed loop is proportional to the rate of change of magnetic flux ✅

B) It says resistance is constant regardless of EMF

C) It proves that EMF equals current times time

D) It states voltage only exists in AC circuit

6. What does “internal resistance” in an EMF source affect?

A) It reduces the actual voltage available to an external circuit ✅

B) It makes the source explode

C) It doubles the EMF output

D) It turns AC into DC

7. Why is EMF not considered a force in the traditional mechanical sense?

A) EMF represents potential energy per unit charge ✅

B) Because it can’t be measured.

C) Because it’s not real.

D) Because it happens only at night.

8. What happens to the EMF of a battery as it discharges over time?

A) It remains relatively constant ✅

B) It instantly goes to zero

C) It reverses direction

D) It turns into resistance

9. What role does a generator play in producing EMF?

A) It uses mechanical energy to rotate coils within a magnetic field ✅

B) It blocks current

C) It increases insulation

D) It filters radio waves

10. Why does an open circuit still show EMF across a battery?

A) Because EMF exists as the potential difference ✅

B) Because the battery is broken

C) Because the air conducts

D) Because electricity is leaking

**Electrical Parameters Гульжайна**

1. What is the SI unit of resistance?

A) Volt

B) Ampere

C) Ohm ✅

D) Watt

2. What does a multimeter typically measure?

A) Voltage only

B) Current only

C) Resistance only

D) Voltage, current, and resistance ✅

3. What is the formula for electrical power?

A) V = I / R

B) P = V \* I ✅

C) P = I/R

D) P = V²/R

4. If the current in a circuit is 2 A and the resistance is 5 Ω, what is the voltage?

A) 10 V ✅

B) 7.5 V

C) 2.5 V

D) 1.5 V

5. Which of the following parameters does a capacitor primarily affect in an AC circuit?

A) Resistance

B) Reactance ✅

C) Inductance

D) Conductance

6. What does the symbol “I” typically represent in electrical formulas?

A) Voltage

B) Resistance

C) Current ✅

D) Power

7. Which of the following is a unit of electrical energy?

A) Volt

B) Watt

C) Ohm

D) Kilowatt-hour ✅

8. What parameter does an ammeter measure?

A) Voltage

B) Current ✅

C) Power

D) Resistance

9. The opposition to current flow in an AC circuit caused by inductors and capacitors is called:

A) Resistance

B) Impedance ✅

C) Voltage

D) Conductance

10. What is the typical frequency of household AC supply in most countries?

A) 100 KHz

B) 60 mHz

C) 50 Hz ✅

D) 25 MHz

**Resistivity Арай**

1. What is the SI unit of resistivity?

A) Ohm

B) Ohm per meter

C) Ohm-meter (Ω·m) ✅

D) Ohms per centimeter

2. Which factor does not affect the resistivity of a material?

A) Temperature

B) Type of material

C) Length of the conductor ✅

D) Atomic structure

3. What happens to the resistivity of most metals as temperature increases?

A) It remains constant

B) It decreases

C) It increases

D) It first increases then decreases ✅

4. Which material would likely have the lowest resistivity?

A) Silver ✅

B) Glass

C) Wood

D) Plastic

5. Resistivity is best described as:

A) A property that depends on the shape of the conductor

B) A measure of current flow

C) A material-specific property that indicates electric current ✅

D)An indication of voltage drop

6. What is the mathematical formula for resistivity?

A) ρ = R \* A

B) ρ = RA / L ✅

C) ρ = L \* RA

D) ρ = R \* L

7. How does the resistivity of a semiconductor change with increasing temperature?

A) It increases

B) It remains constant

C) It fluctuates randomly

D) It absolutely decreases ✅

8. Which of the following statements is true about superconductors?

A) They have high resistivity

B) Their resistivity increases

C) They have a zero resistivity ✅

D) They act like insulators

9. Which is a correct way to experimentally determine resistivity?

A) It measures R, L, and A ✅

B) Use Ohm’s law

C) Measure voltage

D) Use magnetometer

10. Why does copper have lower resistivity than iron?

A) It is cheaper

B) It has more free electrons ✅

C) It’s heavier

D) Iron is magnetic