

Electronics & Communication

1. An optocoupler (or optoisolator) is used to:

- A) Amplify optical signals.
- B) Provide electrical isolation between two circuits.
- C) Generate high-frequency light pulses.
- D) Measure the intensity of light.

Answer: B) Provide electrical isolation between two circuits.

Explanation: An optocoupler uses a light source (like an LED) and a light sensor (like a phototransistor) in the same package to transfer a signal between circuits without a direct electrical connection, which is crucial for safety and noise reduction.

2. The Hall effect is used in sensors to measure:

- A) Temperature.
- B) Strain.
- C) Light intensity.
- D) Magnetic field strength.

Answer: D) Magnetic field strength.

Explanation: When a current-carrying conductor is placed in a magnetic field, a voltage (the Hall voltage) is generated perpendicular to both the current and the field. This voltage is proportional to the magnetic field strength.

3. In a three-phase power system, the phases are typically separated by:

- A) 90 degrees.
- B) 120 degrees.
- C) 180 degrees.
- D) 360 degrees.

Answer: B) 120 degrees.

Explanation: A three-phase system consists of three AC voltages of the same frequency and similar amplitude, with each AC voltage being 120 electrical degrees out of phase with the others, providing smooth and efficient power delivery.

4. The 'h-parameters' (hybrid parameters) are used to model:

- A) The frequency response of a filter.
- B) The behavior of a two-port network, like a transistor.
- C) The power dissipation in a resistor.
- D) The magnetic properties of an inductor.

Answer: B) The behavior of a two-port network, like a transistor.

Explanation: H-parameters are a mix of impedance and admittance parameters that are particularly useful for analyzing the small-signal behavior of BJT amplifiers.

5. A monopole antenna's radiation pattern is:

- A) Isotropic.
- B) Omnidirectional in the horizontal plane.
- C) Highly directional with a single narrow beam.
- D) Bidirectional with two main lobes.

Answer: B) Omnidirectional in the horizontal plane.

Explanation: A quarter-wave vertical monopole antenna radiates equally in all horizontal directions (azimuth), making it ideal for broadcast applications.

6. A varistor is a type of resistor whose resistance is dependent on:

- A) Temperature.
- B) Voltage.
- C) Light.
- D) Frequency.

Answer: B) Voltage.

Explanation: A varistor (Voltage Dependent Resistor) has a very high resistance at low voltages and a very low resistance at high voltages. It is commonly used as a surge protector to clamp voltage spikes.

7. The main purpose of a bleeder resistor in a high-voltage power supply is to:

- A) Improve voltage regulation.
- B) Provide a safety path to discharge the filter capacitors after power is turned off.
- C) Increase the output current capability.

D) Filter the output ripple.

Answer: B) Provide a safety path to discharge the filter capacitors after power is turned off.

Explanation: Filter capacitors can store a lethal charge long after the power is removed. A bleeder resistor provides a continuous path for them to discharge safely.

8. A digital circuit that checks for the number of 1s in a binary word is called a:

- A) Decoder.
- B) Multiplexer.
- C) Parity generator.
- D) Full adder.

Answer: C) Parity generator.

Explanation: A parity generator adds an extra bit (the parity bit) to a binary word to make the total number of 1s either even (even parity) or odd (odd parity). This is used for basic error detection.

9. In control systems, the 'gain margin' is a measure of:

- A) How fast the system responds.
- B) The steady-state error.
- C) The relative stability of the system.
- D) The system's bandwidth.

Answer: C) The relative stability of the system.

Explanation: Gain margin indicates how much the system's gain can be increased before it becomes unstable (oscillates). A larger gain margin implies a more stable system.

10. Which modulation technique is inherently the most immune to noise?

- A) Amplitude Modulation (AM).
- B) Frequency Modulation (FM).
- C) Phase Modulation (PM).
- D) Pulse Code Modulation (PCM).

Answer: D) Pulse Code Modulation (PCM).

Explanation: PCM is a digital modulation technique. Since digital signals are represented by discrete levels (1s and 0s), they can be regenerated perfectly at each repeater, eliminating cumulative noise. Among the analog techniques, FM is more noise-immune than AM.

11. An LVDT (Linear Variable Differential Transformer) is a transducer used to measure:

- A) Temperature.
- B) Pressure.
- C) Displacement.
- D) Flow rate.

Answer: C) Displacement.

Explanation: An LVDT is an electromechanical sensor that converts linear motion or position into a proportional electrical signal with high accuracy and reliability.

12. A thyristor is a semiconductor device that acts as a:

- A) Bistable switch.
- B) Variable resistor.
- C) Current amplifier.
- D) Voltage regulator.

Answer: A) Bistable switch.

Explanation: A thyristor, like an SCR, has two stable states: OFF (high impedance) and ON (low impedance). Once triggered into the ON state, it remains on until the current flowing through it drops below a certain "holding current."

13. The Barkhausen criterion for sustained oscillation in an electronic oscillator requires the loop gain to be:

- A) Less than one in magnitude.
- B) Exactly one in magnitude with a 0° or 360° phase shift.
- C) Greater than one in magnitude.
- D) Exactly one in magnitude with a 180° phase shift.

Answer: B) Exactly one in magnitude with a 0° or 360° phase shift.

Explanation: For an oscillator to produce a stable, continuous output, the signal fed back to the input must be exactly in phase with the original input and have the same amplitude to precisely compensate for losses in the circuit.

14. The 'race condition' in digital logic occurs when:

- A) The output of a circuit depends on the unpredictable sequence or timing of its inputs.
- B) Two logic gates are connected in parallel.

- C) The clock signal is too fast.
- D) The power supply voltage is too low.

Answer: A) The output of a circuit depends on the unpredictable sequence or timing of its inputs.

Explanation: Race conditions are a problem in asynchronous sequential circuits where changing inputs can cause the circuit to enter an unintended state due to propagation delays.

15. In a communication system, 'fading' refers to the:

- A) Loss of signal strength due to distance (path loss).
- B) Variation of signal strength at the receiver due to multipath propagation.
- C) Distortion of the signal due to non-linear amplification.
- D) Interference from other signals.

Answer: B) Variation of signal strength at the receiver due to multipath propagation.

Explanation: Fading occurs when the transmitted signal reaches the receiver via multiple paths, causing constructive and destructive interference that leads to fluctuations in the received signal's amplitude and phase.

16. A Yagi-Uda antenna is a:

- A) Omnidirectional antenna.
- B) Highly directional (beam) antenna.
- C) Log-periodic antenna.
- D) Parabolic reflector antenna.

Answer: B) Highly directional (beam) antenna.

Explanation: A Yagi-Uda antenna uses a driven element, a reflector, and one or more directors to produce a high-gain, unidirectional radiation pattern. It is commonly used for TV reception and point-to-point communication.

17. A PIN diode is often used in microwave circuits as a:

- A) Low-noise amplifier.
- B) High-frequency oscillator.
- C) Switch or attenuator.
- D) Mixer.

Answer: C) Switch or attenuator.

Explanation: A PIN diode has an intrinsic (I) layer between the P and N layers. At RF and microwave frequencies, its resistance can be controlled by the applied DC bias current, allowing it to function as a fast switch or a variable resistor.

18. In satellite communication, VSAT stands for:

- A) Very Small Aperture Terminal.
- B) Variable Satellite Transmission.
- C) Video and Sound Access Terminal.
- D) Voice Satellite System.

Answer: A) Very Small Aperture Terminal.

Explanation: A VSAT is a small-dish satellite ground station used for two-way data, voice, and video communications, often for businesses, remote locations, and internet access.

19. The 'stack pointer' in a microprocessor is a register that:

- A) Holds the address of the next instruction to be executed.
- B) Stores the result of arithmetic operations.
- C) Keeps track of the top of the stack in memory.
- D) Stores the status flags.

Answer: C) Keeps track of the top of the stack in memory.

Explanation: The stack is a LIFO (Last-In, First-Out) memory structure used for subroutine calls and temporary data storage. The stack pointer always points to the most recently added item.

20. The Laplace transform of a unit step function, $u(t)$, is:

- A) 1.
- B) s.
- C) $1/s$.
- D) $1/s^2$.

Answer: C) $1/s$.

Explanation: The Laplace transform is a fundamental tool for solving linear differential equations that describe signals and systems. The transform of the basic step function is $1/s$.

21. In a MOSFET, the 'threshold voltage' (V_t) is the minimum voltage required to:

- A) Cause avalanche breakdown.

- B) Turn the transistor off.
- C) Form a conducting channel between the source and drain.
- D) Damage the device.

Answer: C) Form a conducting channel between the source and drain.

Explanation: The gate-to-source voltage (V_{GS}) must be greater than the threshold voltage for an enhancement-mode MOSFET to turn on and conduct current.

22. The power factor of a purely inductive or purely capacitive circuit is:

- A) 1.
- B) 0.
- C) 0.5.
- D) -1.

Answer: B) 0.

Explanation: In a purely reactive circuit, the voltage and current are 90 degrees out of phase. Since power is calculated as $P = VI\cos(\theta)$, and $\cos(90^\circ) = 0$, no real power is consumed; energy is just stored and returned.

23. An Amici prism is used in some optical instruments to:

- A) Disperse light into a spectrum without deviating the central wavelength.
- B) Polarize light.
- C) Focus a beam of light.
- D) Collimating light.

Answer: A) Disperse light into a spectrum without deviating the central wavelength.

Explanation: It is a compound prism that acts as a direct-vision spectroscope, allowing one to view the spectrum of a light source in line with the source.

24. A rectifier with a capacitor filter produces a DC output with some ripple. Increasing the capacitance value will:

- A) Increase the ripple voltage.
- B) Decrease the ripple voltage.
- C) Have no effect on the ripple voltage.
- D) Increase the output frequency.

Answer: B) Decrease the ripple voltage.

Explanation: A larger capacitor can store more charge and thus discharges less between the rectified peaks. This results in a smoother DC output with a smaller peak-to-peak ripple voltage.

25. The slew rate of an operational amplifier is specified in units of:

- A) dB/decade.
- B) Volts / microsecond ($V/\mu s$).
- C) MHz.
- D) Ohms.

Answer: B) Volts / microsecond ($V/\mu s$).

Explanation: Slew rate measures the maximum rate at which the op-amp's output voltage can change, which limits its performance with high-frequency, large-amplitude signals.

26. Gray code is a binary numeral system where two successive values differ in:

- A) Only one bit.
- B) All bits.
- C) At least two bits.
- D) An even number of bits.

Answer: A) Only one bit.

Explanation: This property of Gray code is very useful in position encoders and for preventing errors in digital systems where a value is changing, as it avoids the intermediate, erroneous states that can occur with standard binary counting.

27. A system's 'phase margin' is used to assess its:

- A) Bandwidth.
- B) Relative stability.
- C) Steady-state error.
- D) Speed of response.

Answer: B) Relative stability.

Explanation: Phase margin is the amount of additional phase lag required to bring the system to the point of instability (oscillation). A larger phase margin indicates a more stable system.

28. The technique of transmitting data over a channel by breaking it into small, fixed-size units is called:

A) Circuit switching.

B) Packet switching.

C) Message switching.

D) Multiplexing.

Answer: B) Packet switching.

Explanation: Packet switching, the fundamental technology of the internet, allows multiple users to share a channel efficiently. Each packet is routed independently through the network.

29. A helical antenna is commonly used for satellite and space communication because it produces:

A) A linearly polarized wave.

B) A circularly polarized wave.

C) An isotropic radiation pattern.

D) A very narrow beam.

Answer: B) A circularly polarized wave.

Explanation: Circular polarization is advantageous because it eliminates the need to align the polarization of the transmitting and receiving antennas, which is crucial when dealing with tumbling or spinning satellites.

30. In a microprocessor, the 'ALU' stands for:

A) Address Logic Unit.

B) Arithmetic Logic Unit.

C) Array Logic Unit.

D) Asynchronous Logic Unit.

Answer: B) Arithmetic Logic Unit.

Explanation: The ALU is the core digital circuit within the CPU that performs integer arithmetic (add, subtract, etc.) and bitwise logic operations (AND, OR, NOT, etc.).

31. The Fourier series is a mathematical tool that represents a periodic signal as:

A) A sum of sine and cosine waves.

B) A product of exponential functions.

C) A polynomial function.

D) A series of impulse functions.

Answer: A) A sum of sine and cosine waves.

Explanation: The Fourier series allows any periodic waveform to be decomposed into a fundamental frequency component and a series of harmonic components, which is essential for signal analysis.

32. The 'Miller effect' in an amplifier describes the apparent increase in the:

- A) Output impedance.
- B) Input capacitance.
- C) Voltage gain.
- D) Bandwidth.

Answer: B) Input capacitance.

Explanation: In an inverting voltage amplifier, the feedback capacitance between the input and output is multiplied by the amplifier's gain, resulting in a much larger effective input capacitance that can limit the high-frequency response.

33. An SCR (Silicon-Controlled Rectifier) can be turned off by:

- A) Applying a negative pulse to the gate.
- B) Applying a positive pulse to the gate.
- C) Reducing the anode current below the holding current.
- D) Increasing the anode voltage.

Answer: C) Reducing the anode current below the holding current.

Explanation: Once an SCR is latched on, the gate loses control. The only way to turn it off is to interrupt the anode current long enough for it to regain its blocking state. This is known as line commutation or forced commutation.

34. A comparator is a circuit that:

- A) Compares two input voltages and produces a digital output indicating which is larger.
- B) Adds two analog signals.
- C) Performs a logical AND operation.
- D) Stores a binary value.

Answer: A) Compares two input voltages and produces a digital output indicating which is larger.

Explanation: A comparator's output will be at one of two logic levels (e.g., $+V_{sat}$ or $-V_{sat}$) depending on whether the non-inverting input is at a higher or lower potential than the inverting input.

35. The 'hand-off' or 'handover' process in a cellular network is the:

- A) Initial connection of a call.
- B) Termination of a call.
- C) Transfer of an active call from one cell to another.
- D) Billing process for a call.

Answer: C) Transfer of an active call from one cell to another.

Explanation: As a mobile user moves from one cell's coverage area into another, the network seamlessly transfers the call to the new cell's base station to maintain the connection.

36. An IMPATT diode is used to generate signals in which frequency range?

- A) Audio frequency.
- B) Radio frequency (RF).
- C) Microwave and millimeter-wave.
- D) Infrared.

Answer: C) Microwave and millimeter-wave.

Explanation: The IMPATT (Impact Ionization Avalanche Transit-Time) diode is a solid-state device that uses avalanche breakdown and transit-time effects to exhibit negative resistance, making it suitable as a powerful oscillator at very high frequencies.

37. The phenomenon where an electromagnetic wave changes direction as it passes from one medium to another is called:

- A) Reflection.
- B) Refraction.
- C) Diffraction.
- D) Dispersion.

Answer: B) Refraction.

Explanation: Refraction is caused by the change in the speed of the wave as it enters a new medium with a different refractive index. Snell's law describes the relationship between the angles of incidence and refraction.

38. The address space of a microprocessor is determined by the:

- A) Width of its data bus.
- B) Width of its address bus.

C) Clock speed.

D) Number of registers.

Answer: B) Width of its address bus.

Explanation: A microprocessor with an n-bit address bus can generate 2^n unique addresses, which defines the total amount of memory it can directly access.

39. A signal that can be described by a mathematical equation and is predictable is known as:

A) A random signal.

B) A deterministic signal.

C) An analog signal.

D) A discrete signal.

Answer: B) A deterministic signal.

Explanation: A deterministic signal has no uncertainty in its value at any point in time. A sine wave is a classic example. In contrast, noise is a random signal.

40. An inductor opposes a change in:

A) Voltage.

B) Current.

C) Resistance.

D) Frequency.

Answer: B) Current.

Explanation: Due to the magnetic field it creates, an inductor resists any change in the current flowing through it. This property is described by the equation $V = L(di/dt)$.

41. A 'bus' in a computer system is a:

A) Set of parallel conductors for transferring data, addresses, and control signals.

B) The main processing unit.

C) A type of memory.

D) A software program.

Answer: A) A set of parallel conductors for transferring data, addresses, and control signals.

Explanation: The system bus acts as a shared communication highway connecting the CPU, memory, and peripheral devices.

42. In a PLL (Phase-Locked Loop) circuit, the 'capture range' is always:

- A) Wider than the lock range.
- B) Narrower than the lock range.
- C) Equal to the lock range.
- D) Unrelated to the lock range.

Answer: B) Narrower than the lock range.

Explanation: The capture range is the range of input frequencies over which the PLL can acquire a lock. The lock range (or tracking range) is the wider range of frequencies over which the PLL can maintain the lock once it has been captured.

43. Which of the following is an example of a weighted binary code?

- A) Gray code.
- B) Excess-3 code.
- C) Binary Coded Decimal (BCD).
- D) ASCII code.

Answer: C) Binary Coded Decimal (BCD).

Explanation: In a weighted code, each bit position has a specific weight. In standard BCD (8421 code), the weights are 8, 4, 2, and 1, just like in pure binary. Gray code and Excess-3 are non-weighted codes.

44. The 'sampling theorem' specifies the minimum sampling rate required to avoid aliasing. This rate is known as the:

- A) Shannon rate.
- B) Nyquist rate.
- C) Baud rate.
- D) Bit rate.

Answer: B) Nyquist rate.

Explanation: The Nyquist-Shannon sampling theorem states that to perfectly reconstruct an analog signal, the sampling frequency must be at least twice the highest frequency component in the signal ($f_s \geq 2f_{\max}$).

45. A 'latch' is a type of bistable multivibrator that is:

- A) Clock-controlled.
- B) Level-triggered.
- C) Edge-triggered.
- D) Self-oscillating.

Answer: B) Level-triggered.

Explanation: A latch changes its output state based on the level (high or low) of its enable or control input, whereas a flip-flop is edge-triggered, meaning it changes state only on the rising or falling edge of a clock signal.

46. The main advantage of a FET over a BJT is its:

- A) Higher voltage gain.
- B) Faster switching speed.
- C) Higher input impedance.
- D) Lower cost.

Answer: C) Higher input impedance.

Explanation: Since the gate of a FET is insulated (MOSFET) or reverse-biased (JFET), it draws virtually no input current, resulting in a very high input impedance that prevents it from loading down the preceding circuit stage.

47. The 'standing wave ratio' (SWR) on a transmission line is a measure of the:

- A) Signal power.
- B) Mismatch between the line impedance and the load impedance.
- C) Signal-to-noise ratio.
- D) Propagation velocity.

Answer: B) Mismatch between the line impedance and the load impedance.

Explanation: SWR indicates the effectiveness of the power transfer. A perfect match results in an SWR of 1:1, meaning all power is delivered to the load. A high SWR indicates that a significant portion of the power is being reflected back from the load.

48. A phototransistor combines the functions of a photodiode and a:

- A) Resistor.
- B) Capacitor.
- C) Zener diode.

D) Transistor amplifier.

Answer: D) Transistor amplifier.

Explanation: A phototransistor is essentially a photodiode whose output current is fed into the base of an internal BJT. This provides amplification, making it much more sensitive to light than a simple photodiode.

49. In a PID controller, the 'integral' term is used to:

- A) Speed up the system's response.
- B) Reduce the steady-state error.
- C) Dampen oscillations.
- D) Predict future errors.

Answer: B) Reduce the steady-state error.

Explanation: The integral action accumulates the error over time. This accumulated value drives the system to completely eliminate any persistent, steady-state error, ensuring the output eventually matches the setpoint exactly.

50. The technique of spreading a signal over a very wide bandwidth using a special code is known as:

- A) Frequency Division Multiplexing (FDM).
- B) Time Division Multiplexing (TDM).
- C) Spread Spectrum.
- D) Quadrature Amplitude Modulation (QAM).

Answer: C) Spread Spectrum.

Explanation: Spread spectrum techniques, like Direct Sequence (DSSS) and Frequency Hopping (FHSS), provide secure communication, resistance to jamming, and allow multiple users to share the same band (as in CDMA).

51. An 'attenuator' is a passive network designed to:

- A) Amplify a signal.
- B) Reduce the amplitude of a signal.
- C) Filter a signal.
- D) Shift the phase of a signal.

Answer: B) Reduce the amplitude of a signal.

Explanation: An attenuator is a simple resistive network that reduces the power or voltage level of a signal by a specific amount (measured in decibels) without distorting its waveform.

52. The 'Hartley' and 'Colpitts' circuits are two common types of:

- A) LC oscillators.
- B) RC oscillators.
- C) Crystal oscillators.
- D) Rectifiers.

Answer: A) LC oscillators.

Explanation: Both Hartley and Colpitts oscillators use an LC tank circuit as the frequency-determining element. The key difference is that the Hartley uses a tapped inductor for feedback, while the Colpitts uses a tapped capacitor.

53. The 'gain-bandwidth product' of an op-amp is:

- A) The product of its open-loop gain and its bandwidth.
- B) The frequency at which the open-loop gain is 0 dB.
- C) The maximum possible gain.
- D) The range of usable frequencies.

Answer: A) The product of its open-loop gain and its bandwidth.

Explanation: For a standard op-amp, the gain-bandwidth product is a constant. This means if you configure the op-amp for a higher closed-loop gain, its bandwidth will decrease proportionally.

54. The process of converting a continuous-time signal into a discrete-time signal is called:

- A) Quantization.
- B) Encoding.
- C) Sampling.
- D) Modulation.

Answer: C) Sampling.

Explanation: Sampling is the first step in analog-to-digital conversion, where the value of the continuous signal is measured at regular, discrete intervals of time.

55. The 'skin effect' in a conductor causes the current to:

- A) Flow uniformly through the entire cross-section.

- B) Concentrate near the surface of the conductor at high frequencies.
- C) Flow only through the center of the conductor.
- D) Stop flowing at high frequencies.

Answer: B) Concentrate near the surface of the conductor at high frequencies.

Explanation: The changing magnetic field inside the conductor induces eddy currents that oppose the main current flow in the center and reinforce it at the surface. This increases the effective resistance of the wire at high frequencies.

56. The 'bandwidth' of an antenna is the:

- A) Physical size of the antenna.
- B) Range of frequencies over which it operates effectively.
- C) Direction of maximum radiation.
- D) Ratio of power radiated to power input.

Answer: B) The range of frequencies over which it operates effectively.

Explanation: Bandwidth is the frequency range where the antenna's performance, particularly its SWR and radiation pattern, remains within acceptable limits.

57. A 'shift register' is a sequential logic circuit used for:

- A) Performing arithmetic operations.
- B) Storing and moving binary data.
- C) Counting pulses.
- D) Generating clock signals.

Answer: B) Storing and moving binary data.

Explanation: A shift register consists of a cascade of flip-flops that share a common clock. With each clock pulse, the data stored in the register is shifted one position to the left or right.

58. A 'geostationary' satellite has an orbital period of:

- A) 90 minutes.
- B) 12 hours.
- C) 24 hours.
- D) 28 days.

Answer: C) 24 hours.

Explanation: A geostationary satellite orbits above the equator at an altitude where its orbital period exactly matches the Earth's rotational period. This makes it appear to remain fixed at one point in the sky.

59. The 'CPU' of a computer is responsible for:

- A) Storing data permanently.
- B) Displaying information on the screen.
- C) Executing program instructions.
- D) Connecting to the network.

Answer: C) Executing program instructions.

Explanation: The Central Processing Unit (CPU) is the brain of the computer, performing the fetch-decode-execute cycle to carry out the instructions of a computer program.

60. The 'admittance' of a circuit element is the reciprocal of its:

- A) Resistance.
- B) Reactance.
- C) Impedance.
- D) Inductance.

Answer: C) Impedance.

Explanation: Admittance (Y), measured in Siemens (S), is a measure of how easily a circuit allows current to flow. It is the complex sum of conductance (G) and susceptance (B). $Y = 1/Z$.