

Electronics & Communication

1. The color code for a $220\ \Omega$ resistor with 5% tolerance is:

- A) Red, Red, Brown, Gold
- B) Red, Red, Black, Gold
- C) Orange, Orange, Brown, Silver
- D) Red, Red, Red, Gold

Answer: A) Red, Red, Brown, Gold

Explanation: Red = 2, Red = 2, Brown = $\times 10^1$ (one zero). So, $220\ \Omega$. Gold represents a $+/- 5\%$ tolerance.

2. A tunnel diode exhibits which of the following properties?

- A) Positive resistance in its operating range
- B) Negative resistance in a portion of its forward bias region
- C) High reverse breakdown voltage
- D) Light-emitting capability

Answer: B) Negative resistance in a portion of its forward bias region

Explanation: Due to the quantum mechanical tunneling effect, the tunnel diode's current decreases as voltage increases over a small forward-bias range. This negative resistance property is useful in high-frequency oscillators.

3. The quality factor (Q) of a series resonant circuit is a measure of its:

- A) Bandwidth
- B) Selectivity or sharpness of resonance
- C) Power consumption
- D) Impedance

Answer: B) Selectivity or sharpness of resonance

Explanation: A high Q-factor indicates a small bandwidth and a sharply peaked resonance curve, meaning the circuit is highly selective to a narrow range of frequencies. $Q = \omega L/R$.

4. The curl of the electrostatic field (E) is always:

- A) Zero

- B) Infinite
- C) Equal to the charge density
- D) A non-zero constant

Answer: A) Zero

Explanation: The equation $\nabla \times E = 0$ signifies that the electrostatic field is a conservative field. This means the line integral of the field around any closed loop is zero.

5. A thermocouple is a transducer that converts:

- A) Light energy into electrical energy
- B) Mechanical energy into electrical energy
- C) Thermal energy into electrical energy
- D) Chemical energy into electrical energy

Answer: C) Thermal energy into electrical energy

Explanation: A thermocouple operates on the Seebeck effect, where a voltage is produced at the junction of two dissimilar metals when that junction is heated.

6. In a step-down cycloconverter, the output frequency is:

- A) Always higher than the input frequency
- B) Always lower than the input frequency
- C) Always equal to the input frequency
- D) A multiple of the input frequency

Answer: B) Always lower than the input frequency

Explanation: A cycloconverter directly synthesizes an AC waveform with a lower frequency from a higher frequency AC source without an intermediate DC link.

7. Crossover distortion is a problem primarily associated with which class of amplifier?

- A) Class A
- B) Class B
- C) Class C
- D) Class D

Answer: B) Class B

Explanation: In a Class B push-pull amplifier, there is a small region where neither transistor is fully conducting, causing distortion near the zero-crossing point of the signal.

8. The number of bits in the American Standard Code for Information Interchange (ASCII) is:

- A) 4
- B) 7
- C) 8
- D) 16

Answer: B) 7

Explanation: Standard ASCII is a 7-bit character code, allowing it to represent 128 different characters. Extended ASCII uses 8 bits to represent 256 characters.

9. The Routh-Hurwitz criterion is used to determine the:

- A) Frequency response of a system
- B) Absolute stability of a system
- C) Time response of a system
- D) Steady-state error

Answer: B) Absolute stability of a system

Explanation: The Routh-Hurwitz criterion is an algebraic method that determines how many poles of the system's characteristic equation lie in the right-half of the s-plane, which indicates instability, without actually solving for the poles.

10. A modem is a device that performs:

- A) Multiplexing and Demultiplexing
- B) Analog-to-Digital and Digital-to-Analog conversion
- C) Modulation and Demodulation
- D) Encoding and Decoding

Answer: C) Modulation and Demodulation

Explanation: A modem MODulates a digital signal onto an analog carrier for transmission over a medium like a telephone line and DEModulates the received analog signal back into a digital signal.

11. An RF amplifier in a radio receiver is used to:

- A) Provide the initial gain and selectivity

- B) Mix the incoming signal with the local oscillator
- C) Demodulate the signal
- D) Drive the speaker

Answer: A) Provide the initial gain and selectivity

Explanation: The Radio Frequency (RF) amplifier, located at the front end of the receiver, amplifies the weak signal from the antenna and provides some initial filtering to reject image frequencies.

12. A circulator is a passive microwave device that is:

- A) Bidirectional
- B) Non-reciprocal
- C) Used for amplification
- D) A type of filter

Answer: B) Non-reciprocal

Explanation: A circulator is a multi-port non-reciprocal device where a signal entering one port is routed to the next port in sequence (e.g., port 1 to port 2, port 2 to port 3) but not in the reverse direction.

13. The orbit used by satellites for the Global Positioning System (GPS) is:

- A) Geostationary Earth Orbit (GEO)
- B) Low Earth Orbit (LEO)
- C) Medium Earth Orbit (MEO)
- D) Highly Elliptical Orbit (HEO)

Answer: C) Medium Earth Orbit (MEO)

Explanation: GPS satellites are in MEO at an altitude of about 20,200 km, allowing a constellation to provide continuous global coverage.

14. The 8085 microprocessor has an address bus that is:

- A) 8 bits wide
- B) 16 bits wide
- C) 20 bits wide
- D) 32 bits wide

Answer: B) 16 bits wide

Explanation: The 16-bit address bus of the 8085 allows it to directly address $2^{16} = 65,536$ (or 64K) unique memory locations.

15. A system is defined as causal if the output at any time depends only on:

- A) Future inputs
- B) Past and present inputs
- C) Present and future inputs
- D) Past inputs only

Answer: B) Past and present inputs

Explanation: A causal system is one that is non-anticipatory; its response does not precede the input that causes it. All real-time physical systems are causal.

16. Ferrite materials are often used in high-frequency applications because they have:

- A) Low permeability and low resistivity
- B) High permeability and low resistivity
- C) Low permeability and high resistivity
- D) High permeability and high resistivity

Answer: D) High permeability and high resistivity

Explanation: High permeability allows them to effectively concentrate magnetic fields, while high resistivity minimizes energy losses due to eddy currents at high frequencies.

17. A Darlington pair is a compound structure of two bipolar transistors that provides very high:

- A) Voltage gain
- B) Output impedance
- C) Current gain
- D) Switching speed

Answer: C) Current gain

Explanation: The total current gain of a Darlington pair is approximately the product of the individual transistor gains ($\beta_{\text{total}} \approx \beta_1 * \beta_2$), making it useful for driving high-current loads with a very small input current.

18. A network that contains no sources of energy is called a:

- A) Passive network

B) Active network

C) Linear network

D) Bilateral network

Answer: A) Passive network

Explanation: A passive network consists only of passive components like resistors, capacitors, and inductors, which can only dissipate or store energy, not generate it.

19. The wave impedance of a transmission line is the ratio of the transverse:

A) Electric field to the transverse magnetic field

B) Magnetic field to the transverse electric field

C) Voltage to the longitudinal current

D) Electric field to the longitudinal magnetic field

Answer: A) Electric field to the transverse magnetic field

Explanation: The characteristic impedance (Z_0) of a transmission line is a fundamental property that describes the relationship between the voltage and current waves propagating along the line.

20. A strain gauge's resistance changes in response to:

A) A change in temperature

B) A change in illumination

C) Applied mechanical force or deformation

D) A change in humidity

Answer: C) Applied mechanical force or deformation

Explanation: Strain gauges are sensors used to measure force, pressure, and weight by detecting the small change in their electrical resistance as they are stretched or compressed.

21. A chopper is a static power electronic device that converts:

A) Fixed DC to variable DC

B) DC to AC

C) AC to DC

D) AC at one frequency to AC at another frequency

Answer: A) Fixed DC to variable DC

Explanation: A chopper is essentially a DC-to-DC converter, analogous to a transformer in an AC circuit. It can step up (boost) or step down (buck) a DC voltage.

22. A Wien bridge oscillator is primarily used to generate:

- A) Square waves
- B) Sawtooth waves
- C) Sinusoidal waves
- D) Pulse trains

Answer: C) Sinusoidal waves

Explanation: The Wien bridge oscillator uses an RC network as its frequency-selective element and is commonly used in audio signal generators due to its low distortion and good stability.

23. Which of the following is a non-volatile memory type?

- A) SRAM (Static RAM)
- B) DRAM (Dynamic RAM)
- C) Cache Memory
- D) EEPROM (Electrically Erasable Programmable ROM)

Answer: D) EEPROM (Electrically Erasable Programmable ROM)

Explanation: Non-volatile memory retains its stored data even when the power is turned off. EEPROM, Flash, and ROM are non-volatile, whereas all forms of RAM are volatile.

24. A system with a pole on the imaginary axis ($j\omega$ -axis) of the s-plane is:

- A) Stable
- B) Unstable
- C) Marginally stable
- D) Conditionally stable

Answer: C) Marginally stable

Explanation: A simple, non-repeated pole on the $j\omega$ -axis results in a sustained oscillation in the system's output, which is neither decaying (stable) nor growing (unstable).

25. Quadrature Amplitude Modulation (QAM) is a modulation scheme that combines:

- A) FM and PM

B) AM and FM

C) ASK and PSK

D) FSK and PSK

Answer: C) ASK and PSK

Explanation: QAM transmits data by modulating both the amplitude and the phase of the carrier wave. It is a combination of Amplitude Shift Keying (ASK) and Phase Shift Keying (PSK), allowing for higher data rates.

26. The ability of a radio receiver to reproduce the original signal frequencies accurately is known as:

A) Selectivity

B) Sensitivity

C) Fidelity

D) Stability

Answer: C) Fidelity

Explanation: Fidelity is a measure of how faithfully the receiver's output reproduces the original modulating signal. High fidelity means low distortion and a wide, flat audio frequency response.

27. The dominant mode of propagation in a rectangular waveguide is:

A) TE10

B) TM11

C) TE20

D) TM01

Answer: A) TE10

Explanation: The dominant mode is the mode with the lowest cutoff frequency. For a standard rectangular waveguide, this is the Transverse Electric TE10 mode.

28. The point in a satellite's orbit where it is farthest from the Earth is called the:

A) Perigee

B) Apogee

C) Zenit

D) Nadir

Answer: B) Apogee

Explanation: For any elliptical orbit around the Earth, the apogee is the point of maximum distance, and the perigee is the point of minimum distance.

29. A 'trap' is a type of instruction in a microprocessor that causes a:

- A) Loop in the program
- B) Hardware reset
- C) Non-maskable interrupt
- D) Division by zero error

Answer: C) Non-maskable interrupt

Explanation: In the 8085, TRAP is the highest priority, non-maskable interrupt. It cannot be disabled by software and is typically used for critical events like power failure.

30. The convolution of a signal with a unit impulse function results in:

- A) The signal itself
- B) The integral of the signal
- C) Zero
- D) A step function

Answer: A) The signal itself

Explanation: The impulse function acts as the identity element for the convolution operation. This property is known as the sifting property. $x(t) * \delta(t) = x(t)$.

31. The temperature coefficient of a semiconductor is:

- A) Positive
- B) Negative
- C) Zero
- D) Infinite

Answer: B) Negative

Explanation: The resistance of a semiconductor material decreases as its temperature increases. This is because thermal energy creates more free electron-hole pairs, increasing conductivity.

32. The process where a BJT is driven into saturation and then into cutoff to operate as a switch is called:

- A) Amplification

B) Oscillation

C) Regulation

D) Inversion

Answer: D) Inversion

Explanation: A common-emitter BJT circuit acts as an inverter or a digital NOT gate. A high input voltage drives it into saturation (ON, low output), and a low input voltage drives it into cutoff (OFF, high output).

33. Norton's equivalent current (I_N) is the current flowing through the:

A) Open-circuited output terminals

B) Short-circuited output terminals

C) Load resistor

D) Equivalent resistance

Answer: B) Short-circuited output terminals

Explanation: To find the Norton current, you replace the load with a short circuit and calculate the current flowing through that short.

34. The Faraday cage is an enclosure used to block:

A) Magnetic fields

B) Gravitational fields

C) Electric fields

D) Nuclear radiation

Answer: C) Electric fields

Explanation: A Faraday cage, made of a conductive material, works by distributing external electric charges or fields around its exterior, canceling out the field's effect on the interior.

35. The resolution of a digital-to-analog converter (DAC) is determined by the:

A) Number of input bits

B) Maximum output voltage

C) Clock frequency

D) Settling time

Answer: A) Number of input bits

Explanation: Resolution is the smallest change in the analog output that can be produced. It is determined by the number of bits (n), where the smallest step is $V_{ref} / 2^n$. More bits lead to a finer resolution.

36. A crowbar circuit is used for:

- A) Overvoltage protection
- B) Overcurrent protection
- C) Soft starting a motor
- D) Generating high voltage pulses

Answer: A) Overvoltage protection

Explanation: A crowbar circuit protects a power supply and its load by rapidly short-circuiting the output (placing a "crowbar" across it) if the voltage exceeds a certain limit, usually blowing a fuse or tripping a breaker.

37. The slew rate of an op-amp is the:

- A) Maximum rate of change of its output voltage
- B) Ratio of output voltage to input voltage
- C) Frequency at which the gain becomes unity
- D) Time it takes for the output to settle

Answer: A) Maximum rate of change of its output voltage

Explanation: Slew rate, measured in $V/\mu s$, limits the op-amp's ability to accurately reproduce high-frequency or large-amplitude signals. Exceeding the slew rate causes signal distortion.

38. The logical expression $Y = A'B + AB'$ represents which logic gate?

- A) AND
- B) NAND
- C) NOR
- D) XOR

Answer: D) XOR

Explanation: This is the Boolean expression for the Exclusive OR (XOR) gate, which produces a high output only when its two inputs are different.

39. The Nyquist stability criterion uses a plot in the complex plane to assess the stability of a:

- A) Open-loop system
- B) Closed-loop system based on its open-loop response
- C) Time-varying system
- D) Non-linear system

Answer: B) Closed-loop system based on its open-loop response

Explanation: The Nyquist criterion involves plotting the open-loop frequency response (Nyquist plot) and counting the number of encirclements of the critical point (-1, 0) to determine the stability of the corresponding closed-loop system.

40. Orthogonal Frequency Division Multiplexing (OFDM) is a technique that divides a channel into many:

- A) Narrowband, closely spaced sub-channels
- B) Wideband, overlapping sub-channels
- C) Time slots
- D) Code-separated channels

Answer: A) Narrowband, closely spaced sub-channels

Explanation: OFDM transmits data on multiple orthogonal sub-carriers in parallel. This makes it highly resistant to multipath fading and is used in systems like Wi-Fi, LTE, and digital broadcasting.

41. Image frequency rejection in a superheterodyne receiver primarily depends on the performance of the:

- A) IF amplifier
- B) RF preselector (tuner)
- C) Audio amplifier
- D) Demodulator

Answer: B) RF preselector (tuner)

Explanation: The RF filter at the front end of the receiver is responsible for passing the desired signal frequency while rejecting the image frequency before it can reach the mixer.

42. In microwave engineering, S-parameters (scattering parameters) relate the:

- A) Incident and reflected voltage waves at different ports
- B) Input and output currents
- C) Electric and magnetic fields

D) Admittance and impedance of the network

Answer: A) Incident and reflected voltage waves at different ports

Explanation: S-parameters are used to characterize high-frequency networks because they are easier to measure than Z, Y, or H parameters, as they do not require open or short circuit conditions which are difficult to achieve at microwave frequencies.

43. The primary purpose of a communications satellite is to act as a:

- A) Power generation station
- B) Repeater station in space
- C) Navigation beacon
- D) Weather monitoring platform

Answer: B) Repeater station in space

Explanation: A satellite receives signals transmitted from a ground station (uplink), amplifies them, changes their frequency, and retransmits them back to Earth to be received over a wide area (downlink).

44. The instruction 'ADD M' in the 8085 microprocessor adds the content of the memory location pointed to by which register pair?

- A) BC
- B) DE
- C) HL
- D) Stack Pointer

Answer: C) HL

Explanation: The 'M' in 8085 instructions refers to the memory location whose address is currently stored in the HL register pair. The result of the addition is stored in the accumulator.

45. The Z-transform is used for the analysis of:

- A) Continuous-time signals and systems
- B) Discrete-time signals and systems
- C) Non-linear systems
- D) Random signals

Answer: B) Discrete-time signals and systems

Explanation: The Z-transform is the discrete-time equivalent of the Laplace transform and is a fundamental tool in digital signal processing and digital control systems.

46. An intrinsic semiconductor at absolute zero temperature behaves like a perfect:

- A) Conductor
- B) Insulator
- C) Superconductor
- D) Resistor

Answer: B) Insulator

Explanation: At 0 Kelvin, there is no thermal energy to excite electrons from the valence band to the conduction band. Therefore, there are no free charge carriers, and the material acts as an insulator.

47. The Early effect in a BJT causes the:

- A) Effective base width to decrease as VCE increases
- B) Collector current to become independent of VCE
- C) Current gain (β) to decrease with temperature
- D) Emitter injection efficiency to increase

Answer: A) Effective base width to decrease as VCE increases

Explanation: As the reverse bias on the collector-base junction (VCE) increases, the depletion region widens, encroaching on the base. This base-width modulation causes the collector current to increase slightly with VCE.

48. The reciprocity theorem is applicable to networks that are:

- A) Linear and bilateral
- B) Nonlinear
- C) Active
- D) Unilateral

Answer: A) Linear and bilateral

Explanation: A bilateral network is one where the relationship between voltage and current is the same regardless of the direction of current flow. The reciprocity theorem applies to such networks.

49. When an electromagnetic wave is incident on a perfect conductor, it is:

- A) Fully transmitted

- B) Fully absorbed
- C) Fully reflected
- D) Partially reflected and partially transmitted

Answer: C) Fully reflected

Explanation: A perfect conductor cannot sustain an electric field inside it. Therefore, the incident wave is completely reflected, with the electric field of the reflected wave being 180 degrees out of phase with the incident wave at the surface.

50. A logic probe is a handheld tool used for testing:

- A) Analog circuits
- B) Digital logic circuits
- C) High-power circuits
- D) The frequency of a signal

Answer: B) Digital logic circuits

Explanation: A logic probe indicates the logic state (high, low, or pulsing) at a particular point in a digital circuit, making it useful for quick troubleshooting.

51. A GTO (Gate Turn-Off Thyristor) can be turned off by:

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

Answer: C) Applying a negative pulse to the gate

Explanation: Unlike a conventional SCR, the GTO can be turned off by applying a sufficiently large negative current pulse to its gate, giving it more control in power switching applications.

52. The common-mode rejection ratio (CMRR) is a critical parameter for which type of amplifier?

- A) Power amplifier
- B) RF amplifier
- C) Differential amplifier
- D) Audio amplifier

Answer: C) Differential amplifier

Explanation: CMRR measures the ability of a differential amplifier (like an op-amp) to reject common-mode signals (noise that appears simultaneously on both inputs) while amplifying the desired differential signal. A high CMRR is desirable.

53. A Karnaugh map (K-map) is a graphical method used for:

- A) Simplifying Boolean expressions
- B) Designing sequential circuits
- C) Analyzing the frequency response of a circuit
- D) Solving differential equations

Answer: A) Simplifying Boolean expressions

Explanation: A K-map provides a systematic way to find the simplest sum-of-products or product-of-sums expression for a logic function, which helps in minimizing the number of logic gates required.

54. The initial response of a control system before it reaches a steady state is known as the:

- A) Transient response
- B) Steady-state response
- C) Impulse response
- D) Error response

Answer: A) Transient response

Explanation: The transient response describes how the system behaves as it changes from its initial state to its final state. Characteristics like rise time, settling time, and overshoot are part of the transient response.

55. In a cellular communication system, the technique of using the same frequencies in different geographic areas is called:

- A) Frequency reuse
- B) Time division duplexing
- C) Code division multiple access
- D) Sectoring

Answer: A) Frequency reuse

Explanation: Frequency reuse is the core concept of cellular systems. By dividing the coverage area into cells, the same set of frequency channels can be reused in non-adjacent cells, dramatically increasing the overall system capacity.

56. The 'squelch' circuit in a communication receiver is used to:

- A) Mute the audio output when no carrier is received
- B) Control the receiver's gain
- C) Tune the receiver to the desired frequency
- D) Filter out high-frequency noise

Answer: A) Mute the audio output when no carrier is received

Explanation: The squelch circuit eliminates the annoying background noise that would otherwise be heard when the receiver is tuned to a frequency with no signal present.

57. A Magic Tee is a microwave component that can be used as a:

- A) Power amplifier
- B) Low-noise amplifier
- C) Mixer or duplexer
- D) High-frequency oscillator

Answer: C) Mixer or duplexer

Explanation: A Magic Tee is a four-port hybrid junction. Depending on which ports are used as inputs and outputs, it can add or subtract signals, making it useful in applications like balanced mixers and antenna duplexers.

58. The bandwidth of the North American analog TV broadcast channel is:

- A) 4 kHz
- B) 200 kHz
- C) 1.25 MHz
- D) 6 MHz

Answer: D) 6 MHz

Explanation: The standard NTSC analog television channel occupied a 6 MHz wide slice of the spectrum to accommodate the video carrier, audio carrier, and guard bands.

59. In the context of a microprocessor, a 'pipeline' is a technique that:

- A) Allows the overlapping of instruction execution stages
- B) Increases the size of the on-chip cache
- C) Connects the CPU to external memory

D) Performs floating-point calculations

Answer: A) Allows the overlapping of instruction execution stages

Explanation: Pipelining improves instruction throughput by breaking down the instruction cycle (fetch, decode, execute, write-back) into stages and working on different instructions in different stages simultaneously, much like an assembly line.

60. The energy of a signal is the:

- A) Integral of its amplitude over all time
- B) Integral of its squared magnitude over all time
- C) Maximum value of the signal
- D) Average value of the signal

Answer: B) Integral of its squared magnitude over all time

Explanation: For a signal $x(t)$, the total energy is defined as $E = \int |x(t)|^2 dt$ from $-\infty$ to $+\infty$. This is a key measure used in signal analysis.