Electronics & Communication

1. A material that has an electrical conductivity between that of a conductor and an insulator is a:

A) Superconductor

B) Semiconductor

C) Dielectric

D) Resistor

Answer: B) Semiconductor

Explanation: Semiconductors, like silicon and germanium, have electrical properties that can be modified by adding impurities (doping), making them the foundation of modern electronic devices.

2. A passive electronic component with two terminals that stores electrical energy in an electric field is a:

A) Resistor

B) Inductor

C) Diode

D) Capacitor

Answer: D) Capacitor

Explanation: A capacitor consists of two conductive plates separated by an insulator (dielectric). It blocks DC current but allows AC current to pass, with its ability to store charge measured in Farads.

3. In a Bipolar Junction Transistor (BJT), the region that is heavily doped and its primary function is to supply charge carriers is the:

A) Base

B) Emitter

C) Collector

D) Substrate

Answer: B) Emitter

Explanation: The emitter is designed to inject a large number of majority charge carriers (electrons or holes) into the base region.

4. Norton's theorem states that any linear electrical network can be replaced by an equivalent circuit consisting of:

A) A voltage source in series with a resistor

B) A current source in parallel with a resistor

C) A voltage source in parallel with a resistor

D) A current source in series with a resistor

Answer: B) A current source in parallel with a resistor

Explanation: Norton's theorem simplifies complex circuits into a single current source (the Norton current) and a single parallel resistor (the Norton resistance).

5. The superposition theorem is applicable only to circuits that are:

A) Nonlinear

B) Linear

C) Time-variant

D) Passive

Answer: B) Linear

Explanation: The superposition theorem allows for the analysis of circuits with multiple sources by considering the effect of each source independently, which only works if the circuit elements have a linear relationship between voltage and current.

6. Maxwell's equations describe the fundamental relationships between:

A) Voltage, current, and resistance

B) Force, mass, and acceleration

C) Electricity, magnetism, and light

D) Temperature, pressure, and volume

Answer: C) Electricity, magnetism, and light

Explanation: These four key equations form the foundation of classical electromagnetism, optics, and electric circuits, describing how electric and magnetic fields are generated and altered by each other and by charges and currents.

7. A Cathode Ray Oscilloscope (CRO) is a device used to:

A) Measure electrical resistance

B) Display and analyze the waveform of electronic signals

C) Generate high-frequency radio waves

D) Measure the magnetic field strength

Answer: B) Display and analyze the waveform of electronic signals

Explanation: The CRO is a versatile instrument that plots a graph of an input signal's voltage over time, allowing for the measurement of amplitude, frequency, and phase.

8. A permanent magnet moving coil (PMMC) instrument gives a reading that is proportional to the:

A) Peak value of the current

B) RMS value of the current

C) Average value of the current

D) Instantaneous value of the current

Answer: C) Average value of the current

Explanation: The deflecting torque in a PMMC instrument is directly proportional to the average current flowing through the coil, which is why it is only suitable for measuring DC quantities.

9. A Silicon Controlled Rectifier (SCR) is a semiconductor device that acts as a:

A) Voltage regulator

B) Bistable switch

C) Current amplifier

D) Variable resistor

Answer: B) Bistable switch

Explanation: An SCR is a type of thyristor that has two stable states: 'off' (high impedance) and 'on' (low impedance). It can be switched 'on' by a small trigger pulse to its gate but can only be turned 'off' by reducing the main current below a holding value.

10. In an ideal operational amplifier (op-amp), the input impedance is:

A) Zero

B) Infinite

C) 100 ohms

D) Equal to the output impedance

Answer: B) Infinite

Explanation: An ideal op-amp draws no current from the input source, which implies it has infinite input impedance. This prevents it from loading the circuit it is connected to.

11. A class A amplifier is an amplifier in which the output current flows for:

A) The full cycle of the input signal

B) Half the cycle of the input signal

C) Less than half the cycle of the input signal

D) More than half but less than the full cycle

Answer: A) The full cycle of the input signal

Explanation: Class A amplifiers are biased so that the transistor is always conducting, resulting in high linearity but poor efficiency (maximum of 50%).

12. A combinational logic circuit that has 2^n input lines and a single output line is a:

A) Demultiplexer

B) Multiplexer

C) Encoder

D) Decoder

Answer: B) Multiplexer

Explanation: A multiplexer (MUX), or data selector, is a circuit that selects one of several input signals and forwards it to a single output, based on the value of its select lines.

13. The basic building block of a sequential logic circuit, capable of storing one bit of information, is the:

A) Logic gate

B) Flip-flop

C) Multiplexer

D) Comparator

Answer: B) Flip-flop

Explanation: A flip-flop is a bistable circuit whose output depends not only on the present inputs but also on the sequence of past inputs and outputs. It is the fundamental memory element.

14. In a closed-loop control system, the difference between the input signal and the feedback signal is called the:

A) Output signal

B) Error signal

C) Control signal

D) Disturbance signal

Answer: B) Error signal

Explanation: The error signal is used by the controller to adjust the system's output to bring it closer to the desired setpoint, thereby reducing the error.

15. The process of varying some characteristic of a high-frequency carrier wave in accordance with the instantaneous value of a message signal is called:

A) Modulation

B) Demodulation

C) Multiplexing

D) Quantization

Answer: A) Modulation

Explanation: Modulation is necessary to transmit low-frequency information signals over long distances efficiently by superimposing them onto a higher-frequency carrier wave.

16. In Amplitude Modulation (AM), the information is carried by the:

A) Frequency of the carrier wave

B) Amplitude of the carrier wave

C) Phase of the carrier wave

D) Pulse width of the carrier wave

Answer: B) Amplitude of the carrier wave

Explanation: In AM, the amplitude of the carrier signal is varied in proportion to the instantaneous amplitude of the message signal, while the frequency and phase remain constant.

17. A superheterodyne receiver uses a local oscillator and a mixer to:

A) Convert the incoming radio frequency (RF) signal to a fixed lower intermediate frequency (IF)

B) Amplify the RF signal directly

C) Demodulate the audio signal

D) Tune to different radio stations

Answer: A) Convert the incoming radio frequency (RF) signal to a fixed lower intermediate frequency (IF)

Explanation: This frequency conversion process allows most of the receiver's amplification and filtering to be done at a constant frequency (IF), which simplifies the design and improves selectivity and sensitivity.

18. In microwave communication, waveguides are used to:

A) Amplify the microwave signal

B) Guide the propagation of electromagnetic waves

C) Generate the microwave signal

D) Demodulate the received signal

Answer: B) Guide the propagation of electromagnetic waves

Explanation: A waveguide is a hollow metal tube that confines and directs microwaves with minimal loss of energy, acting as a transmission line for high-frequency signals.

19. A geostationary satellite is a satellite that:

A) Orbits the Earth in a polar orbit

B) Remains in a fixed position relative to the Earth's surface

C) Has an elliptical orbit

D) Is used for weather forecasting only

Answer: B) Remains in a fixed position relative to the Earth's surface

Explanation: A geostationary satellite orbits the Earth at an altitude of approximately 35,786 km directly above the equator, with an orbital period that matches the Earth's rotation period.

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

A) 8 bits wide

B) 16 bits wide

C) 32 bits wide

D) 4 bits wide

Answer: B) 16 bits wide

Explanation: The 16-bit address bus of the 8085 allows it to access up to 2^16 = 65,536 (64 KB) unique memory locations.

21. A continuous-time signal is a signal that is defined for:

A) Every instant of time

B) Discrete instants of time

C) Only positive values of time

D) Only integer values of time

Answer: A) Every instant of time

Explanation: An analog signal is a continuous-time signal, where the value of the signal is specified for all points in a given time interval.

22. A Zener diode is primarily used as a:

A) Rectifier

B) Voltage regulator

C) Amplifier

D) Oscillator

Answer: B) Voltage regulator

Explanation: A Zener diode is designed to operate in the reverse breakdown region, where it maintains a nearly constant voltage across its terminals despite changes in current, making it ideal for voltage regulation.

23. According to Kirchhoff's Current Law (KCL), the algebraic sum of currents entering and leaving a node in a circuit is:

A) Equal to the supply voltage

B) Infinite

C) Zero

D) Equal to the total resistance

Answer: C) Zero

Explanation: KCL is based on the principle of conservation of charge, stating that the total current flowing into a junction must equal the total current flowing out of it.

24. The unit of magnetic flux density is the:

A) Weber (Wb)

B) Tesla (T)

C) Henry (H)

D) Farad (F)

Answer: B) Tesla (T)

Explanation: Magnetic flux density, or B-field, represents the strength of a magnetic field. One Tesla is defined as one Weber per square meter (Wb/m^2).

25. A Wheatstone bridge is an electrical circuit used to measure an unknown:

A) Voltage

B) Current

C) Resistance

D) Capacitance

Answer: C) Resistance

Explanation: The Wheatstone bridge balances two legs of a bridge circuit, one leg of which includes the unknown component. When the bridge is balanced, the unknown resistance can be calculated from the known resistances.

26. A device that converts electrical energy from one voltage level to another, often with a change in current, is a:

A) Rectifier

B) Inverter

C) Transformer

D) Chopper

Answer: C) Transformer

Explanation: While not strictly a power electronics device, transformers are crucial. A chopper (DC-DC converter) changes DC voltage levels. An inverter converts DC to AC, and a rectifier converts AC to DC. A transformer changes AC voltage levels.

27. An amplifier configuration that provides high input impedance, low output impedance, and a voltage gain of approximately unity is the:

A) Common Emitter

B) Common Base

C) Common Collector (Emitter Follower)

D) Common Source

Answer: C) Common Collector (Emitter Follower)

Explanation: The emitter follower configuration is widely used as a buffer to connect a high-impedance source to a low-impedance load without losing signal strength.

28. The number system that uses only two digits, 0 and 1, is the:

A) Decimal system

B) Octal system

C) Hexadecimal system

D) Binary system

Answer: D) Binary system

Explanation: The binary system is the fundamental language of digital computers, where electronic switches are either 'on' (1) or 'off' (0).

29. The Nyquist stability criterion is a graphical method used in control systems to determine the:

A) Time response of the system

B) Frequency response of the system

C) Stability of a closed-loop system from its open-loop frequency response

D) Root locus of the system

Answer: C) Stability of a closed-loop system from its open-loop frequency response

Explanation: The Nyquist criterion relates the stability of a closed-loop system to the encirclements of the -1 point in the complex plane by the Nyquist plot of the open-loop transfer function.

30. The type of multiplexing where multiple signals are transmitted over a single channel by dividing the channel's bandwidth into separate frequency bands is:

A) Time Division Multiplexing (TDM)

B) Frequency Division Multiplexing (FDM)

C) Code Division Multiplexing (CDM)

D) Wavelength Division Multiplexing (WDM)

Answer: B) Frequency Division Multiplexing (FDM)

Explanation: FDM is commonly used in analog systems like broadcast radio and television, where each station is assigned a specific carrier frequency.

31. In an FM radio receiver, the circuit responsible for detecting the frequency variations of the carrier wave and converting them back into the original audio signal is the:

A) Mixer

B) IF Amplifier

C) Discriminator (or Detector)

D) Audio Amplifier

Answer: C) Discriminator (or Detector)

Explanation: The discriminator is the demodulator in an FM receiver. Its output voltage is proportional to the instantaneous frequency deviation of the input FM signal.

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

A) TE10 mode

B) TM11 mode

C) TE20 mode

D) TM01 mode

Answer: A) TE10 mode

Explanation: The dominant mode is the mode with the lowest cutoff frequency. For a standard rectangular waveguide, this is the Transverse Electric (TE) mode with indices m=1 and n=0.

33. The main advantage of using satellite communication is:

A) Low cost of implementation

B) Wide geographical coverage

C) Low propagation delay

D) High data security

Answer: B) Wide geographical coverage

Explanation: A single satellite can provide communication links over a large portion of the Earth's surface, making it ideal for broadcasting and connecting remote areas.

34. In the 8085 microprocessor, the instruction `MOV A, M` is an example of which addressing mode?

A) Immediate addressing

B) Direct addressing

C) Register indirect addressing

D) Register addressing

Answer: C) Register indirect addressing

Explanation: The 'M' refers to the memory location whose address is currently stored in the HL register pair. The instruction moves the data from that memory location into the accumulator (A).

35. The Fourier Transform is a mathematical tool that decomposes a signal into its constituent:

A) Time-domain components

B) Frequency components

C) Amplitude components

D) Phase components

Answer: B) Frequency components

Explanation: The Fourier Transform converts a signal from the time domain to the frequency domain, showing the amplitude and phase of each frequency that makes up the signal.

36. An intrinsic semiconductor is a semiconductor that is:

A) Heavily doped with donor atoms

B) Heavily doped with acceptor atoms

C) Chemically pure

D) A mixture of silicon and germanium

Answer: C) Chemically pure

Explanation: An intrinsic semiconductor has no added impurities, so the number of excited electrons and the number of holes are equal.

37. An operational amplifier used as an inverting amplifier has a feedback resistor Rf and an input resistor Ri. The closed-loop voltage gain is given by:

A) 1 + (Rf / Ri)

B) - (Rf / Ri)

C) Ri / Rf

D) 1 - (Rf / Ri)

Answer: B) - (Rf / Ri)

Explanation: The negative sign indicates that the output signal is 180 degrees out of phase with the input signal. The gain is determined by the ratio of the two resistors.

38. A J-K flip-flop is a refinement of the S-R flip-flop in that it:

A) Has only one input

B) Is faster than the S-R flip-flop

C) Does not have an invalid or indeterminate state

D) Cannot be used for asynchronous operations

Answer: C) Does not have an invalid or indeterminate state

Explanation: When both J and K inputs are high (1), the J-K flip-flop toggles its output, whereas this input combination is forbidden in a basic S-R flip-flop.

39. The process of converting a digital signal into an analog signal is performed by a:

A) Analog-to-Digital Converter (ADC)

B) Digital-to-Analog Converter (DAC)

C) Modem

D) Encoder

Answer: B) Digital-to-Analog Converter (DAC)

Explanation: A DAC takes digital data as input and outputs a corresponding analog voltage or current. This is essential for applications like audio playback.

40. In a communication system, noise is an unwanted signal that:

A) Is added to the signal at the transmitter

B) Improves the quality of the received signal

C) Degrades the quality of the signal

D) Is removed by the modulation process

Answer: C) Degrades the quality of the signal

Explanation: Noise is any random, undesirable electrical energy that interferes with the transmitted signal, corrupting its information content.

41. A PIN diode is a type of diode where an intrinsic semiconductor region is placed between p-type and n-type regions. It is often used as a:

A) High-frequency switch or attenuator

B) Voltage reference

C) Light-emitting device

D) Rectifier at low frequencies

Answer: A) High-frequency switch or attenuator

Explanation: The wide intrinsic region allows the PIN diode to handle high power and provides a low capacitance, making it suitable for use as an RF switch and variable resistor at microwave frequencies.

42. The transfer function of a system is defined as the Laplace transform of the output divided by the Laplace transform of the input, assuming:

A) All initial conditions are zero

B) The system is nonlinear

C) The input is a step function

D) The system is unstable

Answer: A) All initial conditions are zero

Explanation: The transfer function is a property of the system itself, independent of the input, and is used to characterize the system's dynamic response in the frequency domain.

43. Pulse Code Modulation (PCM) is a digital representation of an analog signal. The process involves:

A) Sampling, quantization, and encoding

B) Modulation, filtering, and amplification

C) Multiplexing, switching, and routing

D) Compressing, encrypting, and transmitting

Answer: A) Sampling, quantization, and encoding

Explanation: PCM is the standard method for converting an analog audio signal into a digital one. The signal is sampled at regular intervals, each sample's amplitude is quantized to a discrete level, and then the level is represented by a binary code.

44. A Traveling Wave Tube (TWT) is a device used in microwave communication to:

A) Generate a high-power microwave signal

B) Act as a high-gain, wide-bandwidth amplifier

C) Mix two microwave frequencies

D) Guide the microwave signal

Answer: B) Act as a high-gain, wide-bandwidth amplifier

Explanation: TWTs are specialized vacuum tubes that amplify radio frequency signals by interacting with a beam of electrons. They are widely used in satellite transponders.

45. The instruction set of a microprocessor refers to the:

A) Set of registers available in the processor

B) Collection of all the machine language instructions that the processor can understand and execute

C) Way the memory is organized

D) Physical pins on the processor chip

Answer: B) Collection of all the machine language instructions that the processor can understand and execute

Explanation: The instruction set defines the fundamental operations the microprocessor can perform, such as arithmetic, logic, data transfer, and control flow.

46. A system is considered linear if it satisfies the properties of:

A) Stability and causality

B) Time-invariance and memory

C) Homogeneity (scaling) and additivity (superposition)

D) Invertibility and linearity

Answer: C) Homogeneity (scaling) and additivity (superposition)

Explanation: These two properties mean that the response of the system to a weighted sum of inputs is equal to the weighted sum of the responses to each individual input.

47. In a series RLC circuit at resonance, the impedance is:

A) Maximum and resistive

B) Minimum and resistive

C) Capacitive only

D) Inductive only

Answer: B) Minimum and resistive

Explanation: At the resonant frequency, the inductive reactance (XL) equals the capacitive reactance (XC), causing them to cancel each other out. The circuit impedance is then at its minimum and equal to the resistance (R).

48. A photodiode is a semiconductor device that converts:

A) Light into electricity

B) Electricity into light

C) Heat into electricity

D) Sound into electricity

Answer: A) Light into electricity

Explanation: When photons of sufficient energy strike the photodiode, they create electron-hole pairs, generating a current proportional to the light intensity.

49. De Morgan's theorem in Boolean algebra states that the complement of a product of variables is equal to the:

A) Product of the complements of the variables

B) Sum of the complements of the variables

C) Complement of the sum of the variables

D) Sum of the variables

Answer: B) Sum of the complements of the variables

Explanation: De Morgan's laws are crucial for simplifying logic circuits. The two laws are: (AB)' = A' + B' and (A + B)' = A'B'.

50. The stability of a control system is a measure of its ability to:

A) Respond quickly to a change in input

B) Maintain its output at a desired value in the presence of disturbances

C) Follow a rapidly changing input signal

D) Avoid large oscillations and maintain a bounded output for a bounded input

Answer: D) Avoid large oscillations and maintain a bounded output for a bounded input

Explanation: A stable system will eventually return to its equilibrium state after being disturbed. An unstable system will have an output that grows without bound.

51. The phenomenon where the energy from a transmitted signal is scattered back towards the transmitter from objects in the path is known as:

A) Refraction

B) Diffraction

C) Backscattering

D) Fading

Answer: C) Backscattering

Explanation: Backscattering is the principle behind radar systems, where the reflected signal is analyzed to determine the location and speed of the object.

52. In satellite communication, the uplink refers to the:

A) Communication link from the satellite to the ground station

B) Communication link from the ground station to the satellite

C) Communication link between two satellites

D) Path of the satellite's orbit

Answer: B) Communication link from the ground station to the satellite

Explanation: The uplink is the transmission of a signal from an Earth-based station to a satellite. The corresponding link from the satellite back to the ground is the downlink.

53. An interrupt in a microprocessor is a signal that:

A) Causes the processor to halt its current operation

B) Indicates an error in the program

C) Temporarily suspends the normal execution of a program to service a high-priority event

D) Corrupts the data in the memory

Answer: C) Temporarily suspends the normal execution of a program to service a high-priority event

Explanation: Interrupts are used to handle events from hardware devices (like a keypress or mouse move) or software, allowing the processor to perform other tasks until an event needs its attention.

54. The process of taking samples of a signal at discrete time intervals is called:

A) Quantizing

B) Sampling

C) Encoding

D) Filtering

Answer: B) Sampling

Explanation: Sampling is the first step in converting an analog signal to a digital signal. The Nyquist-Shannon sampling theorem states the minimum sampling rate required to avoid loss of information.

55. The instrument used to measure the gain and phase shift of a system at various frequencies is a:

A) Spectrum Analyzer

B) Network Analyzer

C) Logic Analyzer

D) Waveform Generator

Answer: B) Network Analyzer

Explanation: A network analyzer measures the S-parameters (scattering parameters) of electrical networks, which characterize how the network reflects and transmits signals.

56. An inverter in power electronics is a circuit that converts:

A) AC power to DC power

B) DC power to AC power

C) A fixed DC voltage to a variable DC voltage

D) One AC frequency to another AC frequency

Answer: B) DC power to AC power

Explanation: Inverters are used in applications like uninterruptible power supplies (UPS), variable-frequency drives for motors, and connecting solar panels to the electrical grid.

57. An astable multivibrator is a circuit that:

A) Has two stable states

B) Has one stable state

C) Has no stable states

D) Is used for storing digital data

Answer: C) Has no stable states

Explanation: An astable multivibrator is a free-running oscillator that continuously switches between two unstable states without any external triggering. It is used to generate a square wave or clock pulse.

58. The number of select lines required for a 16-to-1 multiplexer is:

A) 2

B) 4

C) 8

D) 16

Answer: B) 4

Explanation: The number of select lines (n) is related to the number of input lines (m) by the formula $2^n = m$. In this case, $2^4 = 16$.

59. A key advantage of using fiber optic cables for communication is:

A) Low cost of installation

B) Immunity to electromagnetic interference (EMI)

C) Ease of splicing and connecting

D) Flexibility and ruggedness

Answer: B) Immunity to electromagnetic interference (EMI)

Explanation: Since fiber optic cables transmit data using light pulses instead of electrical signals, they are not affected by nearby power lines, motors, or other sources of electrical noise.

60. A stack in the context of a microprocessor is a:

A) Set of general-purpose registers

B) Type of sequential logic circuit

C) Region of memory used for temporary storage of data in a LIFO manner

D) Hardware device for arithmetic operations

Answer: C) Region of memory used for temporary storage of data in a LIFO manner

Explanation: The stack is used for storing return addresses during subroutine calls, passing parameters to functions, and saving the state of registers. A stack pointer register keeps track of the top of the stack.