

Electronics SET 3

Q1. In a DDR4 memory interface, the primary reason for using “fly-by” topology for the command/address bus is:

- A) To reduce power consumption
- B) To simplify routing by having a single trace length
- C) To improve signal integrity and enable better timing margins at high speed
- D) To allow bidirectional data flow on the address bus

Answer: C

Explanation: DDR4 uses a fly-by topology for command/address/control signals, where signals travel from the controller to each DRAM in sequence. This reduces simultaneous switching noise, improves signal integrity, and supports higher frequencies compared to the T-topology used in DDR3.

Q2. In FPGA-based Ethernet MAC design for 10G, the XGMII interface operates at:

- A) 125 MHz with 8-bit data
- B) 156.25 MHz with 64-bit data
- C) 312.5 MHz with 32-bit data
- D) 625 MHz with 16-bit data

Answer: B

Explanation: The XGMII (10 Gigabit Media Independent Interface) runs at 156.25 MHz with 64-bit wide data paths in each direction to achieve 10 Gbps throughput ($156.25 \text{ MHz} \times 64 \text{ bits} = 10 \text{ Gbps}$).

Q3. In SPI communication, which of the following modes corresponds to CPOL = 1, CPHA = 0?

- A) Mode 0
- B) Mode 1
- C) Mode 2
- D) Mode 3

Answer: C

Explanation: SPI modes are determined by clock polarity (CPOL) and phase (CPHA):

- Mode 0: CPOL=0, CPHA=0
 - Mode 1: CPOL=0, CPHA=1
 - Mode 2: CPOL=1, CPHA=0
 - Mode 3: CPOL=1, CPHA=1.
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Q4. Which of the following is the main advantage of using LVDS signaling in high-speed FPGA transceivers?

- A) Higher voltage swing for noise immunity
- B) Low power consumption and reduced EMI
- C) Eliminates the need for termination resistors
- D) Allows asynchronous data transfer

Answer: B

Explanation: LVDS (Low Voltage Differential Signaling) uses low voltage swings (~350 mV) and differential pairs, leading to lower EMI and reduced power consumption while supporting high data rates.

Q5. In embedded C programming for microcontrollers, using volatile keyword for a hardware register variable ensures:

- A) The compiler will optimize it for speed
- B) The variable is stored in flash memory
- C) The compiler will not optimize it away, always reading from memory
- D) It is shared between multiple threads

Answer: C

Explanation: volatile tells the compiler that the value can change unexpectedly (e.g., hardware register), so it should always fetch from memory instead of using cached values in registers.

Q6. In DDR memory controller design, the term “write leveling” refers to:

- A) Adjusting data lines to match control lines delay
- B) Calibrating write strobe timing to match DRAM clock
- C) Matching read latency across all memory banks
- D) Equalizing power consumption during writes

Answer: B

Explanation: Write leveling compensates for clock-to-DQS skew in DDR3/DDR4 systems caused by fly-by topology, ensuring correct data capture by adjusting the DQS timing during writes.

Q7. Which protocol allows error detection and retransmission at the Data Link layer in Ethernet?

- A) ARP
- B) TCP
- C) IP
- D) None of the above

Answer: D

Explanation: Ethernet (IEEE 802.3) includes CRC error detection in the frame but does not provide retransmission. Retransmission is handled by higher-layer protocols like TCP.

Q8. In FPGA design using Vivado, “timing closure” means:

- A) The design compiles without syntax errors
- B) All timing constraints are met for setup and hold times
- C) The design fits within available logic resources
- D) The synthesis is completed without warnings

Answer: B

Explanation: Timing closure refers to ensuring all timing paths meet setup and hold requirements under all operating conditions, ensuring reliable operation at the target clock frequency.

Q9. Which I²C feature allows multiple devices to communicate without bus contention?

- A) Differential signaling
- B) Open-drain configuration with pull-up resistors
- C) Fixed priority arbitration
- D) High voltage level signaling

Answer: B

Explanation: I²C uses open-drain outputs with pull-ups so multiple devices can pull the line low without contention, allowing arbitration.

Q10. In high-speed PCB design, the term “via stub” refers to:

- A) A short test pad
- B) An unused branch of a via that can cause signal reflections
- C) A microvia used for differential pairs
- D) The plated-through hole diameter

Answer: B

Explanation: A via stub is the unused length of a via barrel below the signal layer transition, which can cause impedance discontinuities and reflections, especially in high-speed signals.

Q11. In an FPGA, Block RAM (BRAM) typically:

- A) Has lower latency than LUT RAM
- B) Consumes less area for larger storage
- C) Is located only at chip edges
- D) Is used only for configuration data

Answer: B

Explanation: BRAM provides larger, more efficient storage with predictable performance, ideal for buffers, FIFOs, and memory blocks, while LUT RAM is better for small distributed storage.

Q12. In UART communication, a “break condition” means:

- A) Line is idle for more than 10 character times
- B) Line is held low longer than one frame duration
- C) Line is held high for more than 1 second
- D) Frame is received with parity error

Answer: B

Explanation: A break condition occurs when the TX line is held low longer than the time to transmit a complete frame, signaling an out-of-band event or reset.

Q13. In QDR SRAM, the term “Quad Data Rate” means:

- A) Transfers occur four times per clock cycle
- B) Two read and two write operations per clock cycle
- C) Four times the bandwidth of SDRAM
- D) Writes are four times faster than reads

Answer: B

Explanation: QDR SRAM supports independent read and write ports, allowing two read and two write operations per clock cycle (double data rate on both read and write).

Q14. In FPGA Verilog design, the construct always @(*) is used for:

- A) Synchronous logic
- B) Asynchronous combinational logic
- C) Edge-triggered registers
- D) Memory initialization

Answer: B

Explanation: always @(*) infers combinational logic and automatically includes all signals used inside the block in its sensitivity list.

Q15. Which Ethernet standard supports full-duplex operation at 1 Gbps over copper twisted pair?

- A) 1000BASE-T
- B) 1000BASE-SX
- C) 100BASE-TX
- D) 10GBASE-T

Answer: A

Explanation: 1000BASE-T uses four pairs of Cat5e/Cat6 twisted pair, supporting 1 Gbps full-duplex up to 100 meters.

Q16. In mixed-signal PCB design, splitting analog and digital grounds is recommended to:

- A) Reduce voltage drop in ground planes
- B) Prevent digital switching noise from coupling into analog circuits

- C) Simplify PCB routing
- D) Increase current capacity

Answer: B

Explanation: Digital circuits generate high-frequency noise that can couple into sensitive analog circuits; splitting and connecting grounds at a single point helps minimize interference.

Q17. In DDR memory, the “burst length” determines:

- A) Number of bits per clock cycle
- B) Number of sequential data words per read/write command
- C) Refresh interval
- D) Maximum clock frequency

Answer: B

Explanation: Burst length defines how many consecutive words are transferred after a single read/write command, improving throughput efficiency.

Q18. In an FPGA transceiver, “equalization” is used to:

- A) Increase transmission power
- B) Compensate for frequency-dependent loss in channels
- C) Reduce jitter in clock signals
- D) Improve thermal stability

Answer: B

Explanation: Equalization boosts high-frequency components attenuated by PCB traces and connectors, enabling reliable high-speed data transfer.

Q19. In SPI, the maximum achievable speed is usually limited by:

- A) CPU clock frequency
- B) The slowest device on the bus
- C) Number of connected devices
- D) SPI mode number

Answer: B

Explanation: SPI operates at the highest speed supported by all connected devices; the slowest device determines the maximum usable clock rate.

Q20. In VHDL, which statement is correct regarding signal and variable?

- A) Both update immediately in simulation
- B) signal updates after a delta cycle, variable updates immediately
- C) variable updates after delta cycle, signal updates immediately
- D) They behave identically in all cases

Answer: B

Explanation: In VHDL, signal assignments are scheduled for future update (delta cycle), while variable assignments take effect immediately within the process.

Q21. Which PCB layer stack-up arrangement is best for high-speed differential pairs?

- A) Signal – Power – Signal – Ground
- B) Signal – Ground – Signal – Power
- C) Signal – Ground – Power – Signal
- D) Power – Signal – Ground – Signal

Answer: B

Explanation: Placing a ground plane adjacent to high-speed signal layers minimizes impedance variation and crosstalk, improving signal integrity.

Q22. In Ethernet 100BASE-TX, MLT-3 encoding is used primarily to:

- A) Increase maximum cable length
- B) Reduce EMI by limiting bandwidth
- C) Increase data rate
- D) Provide error correction

Answer: B

Explanation: MLT-3 reduces frequency components compared to NRZ encoding, helping limit EMI while maintaining the required data rate.

Q23. Which type of FPGA memory is most suitable for implementing FIFOs between different clock domains?

- A) LUT RAM

- B) Distributed RAM
- C) Dual-port Block RAM
- D) Shift registers

Answer: C

Explanation: Dual-port BRAM allows independent read/write ports with separate clocks, making it ideal for clock domain crossing FIFOs.

Q24. In microcontroller boot process, the Boot ROM usually contains:

- A) User application code
- B) Minimal code to initialize hardware and load application
- C) Operating system kernel
- D) Debugger firmware only

Answer: B

Explanation: Boot ROM has a small immutable program that initializes essential hardware, configures clocks/memory, and loads the main application from storage.

Q25. In DDR4 memory timing parameters, tRCD stands for:

- A) Row to Column Delay
- B) Refresh to Column Delay
- C) Row Cycle Delay
- D) Read Command Delay

Answer: A

Explanation: tRCD is the delay between activating a row (ACT command) and issuing a read/write to that row (column access), measured in clock cycles.

Q26. In a microwave receiver, the image frequency is:

- A) Always equal to the IF frequency
- B) Above or below the desired frequency by twice the IF frequency
- C) Independent of the LO frequency
- D) Equal to the LO frequency

Answer: B) Above or below the desired frequency by twice the IF frequency

Explanation: In a superheterodyne receiver, the image frequency

$f_{image} = f_{RF} \pm 2f_{IF}$. If not filtered, the image frequency will mix down to the same IF as the desired signal, causing interference.

Q27. Which material is most commonly used for microwave stripline substrates due to low dielectric loss?

- A) FR-4
- B) Rogers RT/duroid
- C) Silicon
- D) Aluminum oxide

Answer: B) Rogers RT/duroid

Explanation: Rogers laminates have low dielectric constant variation and low loss tangent, making them ideal for high-frequency microwave PCBs compared to FR-4, which suffers high loss at GHz frequencies.

Q28. The purpose of a circulator in an RF transceiver is to:

- A) Combine two RF signals into one
- B) Isolate transmitter and receiver using a single antenna
- C) Match impedance between components
- D) Generate local oscillator signals

Answer: B) Isolate transmitter and receiver using a single antenna

Explanation: A circulator is a non-reciprocal passive device that routes signals in one direction only, enabling a shared antenna to be used for transmit and receive paths without interference.

Q29. In a frequency synthesizer, a **phase-locked loop (PLL)** is used to:

- A) Filter out noise from an RF signal
- B) Lock an oscillator to a reference frequency
- C) Increase output power
- D) Reduce antenna impedance

Answer: B) Lock an oscillator to a reference frequency

Explanation: PLLs are feedback control systems that lock a VCO output

frequency to a stable reference frequency, enabling stable and programmable RF generation.

Q30. The figure of merit for a Low Noise Amplifier (LNA) is best described by:

- A) High noise figure, high gain
- B) Low noise figure, moderate gain, high linearity
- C) High gain, high distortion
- D) Low bandwidth, low noise

Answer: B) Low noise figure, moderate gain, high linearity

Explanation: LNAs should minimize noise (low NF), provide enough gain to overcome mixer noise, and have high linearity to handle strong adjacent signals without distortion.

Q31. Which parameter defines the maximum input signal level an RF amplifier can handle without significant distortion?

- A) Noise figure
- B) 1 dB compression point
- C) Phase noise
- D) Return loss

Answer: B) 1 dB compression point

Explanation: The 1 dB compression point is the input level where the amplifier's gain drops by 1 dB from the small-signal gain, indicating the onset of non-linear distortion.

Q32. In a passive RF mixer, conversion loss is defined as:

- A) LO power – RF power
- B) RF power / IF power
- C) Difference between input RF power and output IF power
- D) Gain from RF to IF

Answer: C) Difference between input RF power and output IF power

Explanation: Passive mixers typically have a conversion loss (rather than gain) due to diode switching losses, typically in the range of 5–9 dB.

Q33. The main advantage of a superheterodyne receiver over a direct-conversion receiver is:

- A) Lower cost
- B) Better image rejection and selectivity
- C) Reduced component count
- D) Elimination of local oscillator

Answer: B) Better image rejection and selectivity

Explanation: The IF stage in a superheterodyne design allows for narrowband filtering, improving selectivity and image rejection compared to direct-conversion architectures.

Q34. Which component is used to combine two RF signals of different frequencies without significant loss?

- A) Wilkinson combiner
- B) Diplexer
- C) Directional coupler
- D) Hybrid ring

Answer: B) Diplexer

Explanation: A diplexer is a passive device that combines/separates signals at different frequency bands into a single port with minimal loss.

Q35. At microwave frequencies, waveguides are preferred over coaxial cables because:

- A) They are more flexible
- B) They have lower loss at high frequencies
- C) They are cheaper
- D) They require no impedance matching

Answer: B) They have lower loss at high frequencies

Explanation: Waveguides offer very low attenuation for signals above a few GHz, unlike coaxial cables where skin effect and dielectric loss become significant.

Q36. Which type of filter is most commonly used in RF front-end designs for narrowband channel selection?

- A) Low-pass filter
- B) Band-pass filter
- C) High-pass filter
- D) All-pass filter

Answer: B) Band-pass filter

Explanation: Band-pass filters allow only the desired frequency band to pass, rejecting both lower and higher unwanted signals, making them essential in RF front-ends.

Q37. In a microwave power amplifier, Class AB operation is preferred over Class A because:

- A) It is cheaper
- B) It offers better linearity
- C) It offers higher efficiency with acceptable linearity
- D) It eliminates harmonics completely

Answer: C) It offers higher efficiency with acceptable linearity

Explanation: Class AB amplifiers provide a good compromise between Class A's linearity and Class B's efficiency, making them suitable for RF transmitters.

Q38. In the Smith Chart, moving towards the generator represents:

- A) Adding inductive reactance
- B) Moving towards higher impedance
- C) Moving towards the load
- D) Decreasing electrical length

Answer: A) Adding inductive reactance

Explanation: On a Smith chart, movement toward the generator increases phase delay, and depending on the position, can represent inductive reactance.

Q39. Which receiver architecture eliminates the image frequency problem completely?

- A) Superheterodyne
- B) Direct-conversion (zero-IF)
- C) Double conversion
- D) Regenerative

Answer: B) Direct-conversion (zero-IF)

Explanation: Zero-IF receivers mix the RF directly to baseband, so there is no IF and hence no image frequency.

Q40. The purpose of using a Wilkinson power divider instead of a resistive splitter is:

- A) Higher loss
- B) Isolation between output ports with low insertion loss
- C) To work only at low frequencies
- D) Eliminate standing waves completely

Answer: B) Isolation between output ports with low insertion loss

Explanation: The Wilkinson divider uses quarter-wave transformers and a resistor to provide port isolation with minimal insertion loss.

Q41. In RF simulation tools like ADS or AWR, the “S-parameters” represent:

- A) Scattering parameters describing reflection and transmission
- B) Source voltages in a network
- C) Standing wave patterns
- D) Signal-to-noise ratios

Answer: A) Scattering parameters describing reflection and transmission

Explanation: S-parameters quantify how RF energy is scattered through a network — essential for analyzing multi-port RF components.

Q42. The parameter “phase noise” in frequency synthesizers affects:

- A) Output power
- B) Signal purity and adjacent channel interference

- C) Antenna gain
- D) Mixer efficiency

Answer: B) Signal purity and adjacent channel interference

Explanation: High phase noise spreads the carrier energy into adjacent frequencies, causing interference and reducing spectral purity.

Q43. The main advantage of using a log detector in RF power measurement is:

- A) It requires no calibration
- B) Wide dynamic range
- C) Works only at low frequencies
- D) No temperature sensitivity

Answer: B) Wide dynamic range

Explanation: Log detectors provide an output voltage proportional to the logarithm of input power, allowing accurate measurement over many decades of dynamic range.

Q44. A PIN diode in an RF switch acts primarily as:

- A) Voltage regulator
- B) Variable resistor at RF frequencies
- C) Oscillator
- D) Mixer

Answer: B) Variable resistor at RF frequencies

Explanation: In RF switches, a PIN diode's resistance changes with bias current, allowing it to act as a controllable RF path element.

Q45. Which microwave device works on the principle of velocity modulation?

- A) Klystron
- B) Magnetron
- C) Traveling wave tube
- D) All of the above

Answer: D) All of the above

Explanation: Klystrons, magnetrons, and TWTs all utilize velocity modulation of an electron beam to generate or amplify microwaves.

Q46. In a low-noise receiver, why is the first stage often a band-pass filter before the LNA?

- A) To improve noise figure
- B) To reject out-of-band strong signals
- C) To increase gain
- D) To reduce LO leakage

Answer: B) To reject out-of-band strong signals

Explanation: A preselector band-pass filter prevents strong unwanted signals from overloading the LNA, improving overall performance.

Q47. Which microwave measurement technique uses a slotted line?

- A) Measuring VSWR and impedance
- B) Determining noise figure
- C) Measuring harmonic distortion
- D) Measuring phase noise

Answer: A) Measuring VSWR and impedance

Explanation: A slotted line allows sampling of standing wave patterns in a waveguide or coaxial line to determine VSWR and impedance.

Q48. What is the main role of a frequency doubler in RF systems?

- A) Reduce signal frequency
- B) Increase frequency by 2x
- C) Mix two signals together
- D) Eliminate harmonics

Answer: B) Increase frequency by 2x

Explanation: Frequency doublers use nonlinear devices to generate harmonics, selecting the second harmonic for output.

Q49. Which type of RF connector is best suited for 18 GHz applications with low reflection?

- A) BNC
- B) SMA
- C) N-Type
- D) UHF PL-259

Answer: B) SMA

Explanation: SMA connectors have low VSWR and can handle frequencies up to 18 GHz, making them ideal for microwave systems.

Q50. The **Q-factor** of a resonator is a measure of:

- A) Bandwidth to center frequency ratio
- B) Noise floor
- C) Power handling capability
- D) Antenna gain

Answer: A) Bandwidth to center frequency ratio

Explanation: $Q = f_0 / BW$ f_0 is center frequency and BW is bandwidth. Higher Q means narrower bandwidth and better selectivity.

Q51. In QPSK modulation, how many bits are transmitted per symbol?

- A) 1
- B) 2
- C) 3
- D) 4

Answer: B) 2

Explanation: Quadrature Phase Shift Keying (QPSK) uses four distinct phase states, each representing 2 bits. This allows higher spectral efficiency compared to BPSK.

Q52. The main reason for using Gray coding in digital modulation mapping is:

- A) To increase bandwidth efficiency
- B) To reduce bit errors in symbol errors

- C) To simplify demodulator design
- D) To improve SNR

Answer: B) To reduce bit errors in symbol errors

Explanation: In Gray coding, only one bit changes between adjacent symbols. This reduces the number of bit errors when a symbol error occurs due to noise.

Q53. In OFDM systems, the main technique used to mitigate Inter-Symbol Interference (ISI) is:

- A) Equalization
- B) Cyclic Prefix
- C) Frequency Hopping
- D) Beamforming

Answer: B) Cyclic Prefix

Explanation: A cyclic prefix is a copy of the end of the OFDM symbol inserted at the beginning. It acts as a guard interval to prevent ISI from multipath propagation.

Q54. In SIP (Session Initiation Protocol), which request method is used to establish a session?

- A) ACK
- B) INVITE
- C) REGISTER
- D) OPTIONS

Answer: B) INVITE

Explanation: In SIP, the INVITE method initiates a call or multimedia session. The ACK confirms a final response, while REGISTER updates a server with a client's location.

Q55. Which of the following is NOT a physical layer specification?

- A) QAM modulation
- B) Frequency allocation

- C) CSMA/CA
- D) OFDM subcarrier spacing

Answer: C) CSMA/CA

Explanation: CSMA/CA is a MAC layer (Layer 2) protocol used in IEEE 802.11 wireless networking, not a physical layer feature.

Q56. The Shannon–Hartley theorem defines:

- A) The minimum BER achievable for a given SNR
- B) The maximum data rate of a channel for given bandwidth and SNR
- C) The ideal modulation type for maximum range
- D) The antenna gain required for a given link

Answer: B) The maximum data rate of a channel for given bandwidth and SNR

Explanation: Shannon–Hartley capacity formula:

$$C = B \log_2 (1 + \text{SNR})$$

Where C is capacity, B is bandwidth, and SNR is the signal-to-noise ratio.

Q57. Which networking protocol is connection-oriented and guarantees delivery?

- A) UDP
- B) TCP
- C) ICMP
- D) ARP

Answer: B) TCP

Explanation: TCP (Transmission Control Protocol) establishes a reliable, ordered, and error-checked data delivery mechanism, unlike UDP which is connectionless.

Q58. In satellite communication, **uplink frequency** is usually higher than downlink frequency because:

- A) Satellites have limited transmitter power
- B) Lower frequencies suffer more atmospheric loss
- C) Ground stations can generate higher power signals
- D) To avoid Doppler shift

Answer: C) Ground stations can generate higher power signals

Explanation: Uplink uses higher frequencies as ground stations have powerful transmitters, while satellites use lower downlink frequencies to save onboard power.

Q59. In digital communication, **BER** stands for:

- A) Binary Error Rate
- B) Bit Error Rate
- C) Baseband Encoding Ratio
- D) Bandwidth Efficiency Ratio

Answer: B) Bit Error Rate

Explanation: BER is the ratio of incorrectly received bits to the total number of bits transmitted, and is a key measure of communication quality.

Q60. In wireless networking, the **hidden node problem** can be reduced using:

- A) RTS/CTS handshake
- B) Increasing transmit power
- C) OFDM modulation
- D) Using directional antennas

Answer: A) RTS/CTS handshake

Explanation: The Request-to-Send/Clear-to-Send mechanism ensures that nodes reserve the channel before transmission, avoiding collisions caused by hidden nodes.

Q61. Which modulation scheme has the highest bandwidth efficiency?

- A) BPSK
- B) QPSK

- C) 16-QAM
- D) 64-QAM

Answer: D) 64-QAM

Explanation: 64-QAM transmits 6 bits per symbol, achieving higher spectral efficiency but requiring higher SNR for reliable communication.

Q62. In MATLAB, the function `awgn(signal, snr)` adds:

- A) Amplitude scaling
- B) White Gaussian noise
- C) Phase distortion
- D) Channel fading

Answer: B) White Gaussian noise

Explanation: The `awgn` function simulates real-world noise by adding additive white Gaussian noise to a signal for testing purposes.

Q63. In a superheterodyne receiver, the main advantage of using an intermediate frequency (IF) is:

- A) Improved antenna gain
- B) Easier filtering and amplification
- C) Reduced noise figure
- D) Higher modulation speed

Answer: B) Easier filtering and amplification

Explanation: Converting to a fixed IF allows the use of high-performance filters and amplifiers optimized for a specific frequency, improving selectivity.

Q64. Which MAC layer protocol is used in Ethernet networks?

- A) CSMA/CA
- B) CSMA/CD
- C) TDMA
- D) ALOHA

Answer: B) CSMA/CD

Explanation: Ethernet uses Carrier Sense Multiple Access with Collision

Detection, where nodes listen before sending and detect collisions during transmission.

Q65. Which protocol is primarily used for VoIP signaling?

- A) SMTP
- B) SIP
- C) FTP
- D) ARP

Answer: B) SIP

Explanation: Session Initiation Protocol (SIP) sets up, modifies, and terminates multimedia communication sessions like VoIP calls.

Q66. In a digital receiver, **symbol rate** is:

- A) Bits transmitted per second
- B) Symbols transmitted per second
- C) Bandwidth per channel
- D) Modulation index

Answer: B) Symbols transmitted per second

Explanation: Symbol rate (baud rate) is the number of symbols sent per second. Each symbol may represent multiple bits depending on modulation.

Q67. Which of the following is an example of **spread spectrum** technique?

- A) QPSK
- B) DSSS
- C) 8-QAM
- D) ASK

Answer: B) DSSS

Explanation: Direct Sequence Spread Spectrum (DSSS) spreads the signal over a wider frequency band, improving resistance to interference.

Q68. The main advantage of **MIMO** systems in wireless communication is:

- A) Increased modulation order
- B) Better error correction
- C) Increased capacity and reliability
- D) Reduced power consumption

Answer: C) Increased capacity and reliability

Explanation: Multiple-Input Multiple-Output (MIMO) uses multiple antennas at both transmitter and receiver to increase channel capacity and link robustness.

Q69. In radio communication, **fading** refers to:

- A) Loss of carrier frequency
- B) Variation in signal amplitude over time
- C) Phase noise in oscillators
- D) Doppler frequency shift

Answer: B) Variation in signal amplitude over time

Explanation: Fading is caused by multipath propagation and results in fluctuations in received signal strength.

Q70. In MATLAB, the command `pskmod(data, M)` is used for:

- A) Pulse shaping
- B) M-ary PSK modulation
- C) FFT computation
- D) Channel estimation

Answer: B) M-ary PSK modulation

Explanation: This function performs phase shift keying modulation with M possible symbols.

Q71. Which of the following is a **wired networking** standard?

- A) IEEE 802.3
- B) IEEE 802.11
- C) IEEE 802.15
- D) IEEE 802.16

Answer: A) IEEE 802.3

Explanation: IEEE 802.3 defines Ethernet standards for wired LAN communication.

Q72. In a QAM constellation diagram, increasing the number of points:

- A) Increases robustness to noise
- B) Increases bandwidth requirement
- C) Increases spectral efficiency but reduces noise tolerance
- D) Reduces data rate

Answer: C) Increases spectral efficiency but reduces noise tolerance

Explanation: Higher-order QAM carries more bits per symbol but requires higher SNR to maintain the same BER.

Q73. In satellite communications, **geostationary satellites** orbit at approximately:

- A) 360 km
- B) 2,000 km
- C) 35,786 km
- D) 100,000 km

Answer: C) 35,786 km

Explanation: Geostationary orbit is at ~35,786 km above the equator, matching Earth's rotation so the satellite appears fixed in the sky.

Q74. In TCP/IP networking, which layer is responsible for end-to-end delivery of data segments?

- A) Application Layer
- B) Network Layer
- C) Transport Layer
- D) Data Link Layer

Answer: C) Transport Layer

Explanation: The transport layer ensures reliable data transfer between hosts using protocols like TCP and UDP.

Q75. Which MATLAB function is used to perform a Fast Fourier Transform (FFT)?

- A) fft()
- B) ft()
- C) fourier()
- D) dft()

Answer: A) fft()

Explanation: fft() computes the discrete Fourier transform efficiently using the Fast Fourier Transform algorithm.

Q76. Which of the following statements about a directional antenna is TRUE?

- A) It radiates equally in all directions
- B) It has higher gain than an omnidirectional antenna in its main lobe
- C) It always operates over a wide frequency range
- D) It cannot be used for satellite communication

Answer: B) It has higher gain than an omnidirectional antenna in its main lobe

Explanation: Directional antennas focus energy in a particular direction, resulting in higher gain compared to omni antennas, making them ideal for point-to-point and satellite links.

Q77. The **primary purpose** of a **duplexer** in an RF transceiver system is:

- A) To amplify both transmit and receive signals
- B) To allow simultaneous transmission and reception using a single antenna
- C) To improve noise figure in the receiver
- D) To filter out harmonics

Answer: B) To allow simultaneous transmission and reception using a single antenna

Explanation: Duplexers separate transmit and receive paths at the same

frequency band, enabling full-duplex operation on one antenna without mutual interference.

Q78. In a frequency synthesizer, a **phase-locked loop (PLL)** is used primarily to:

- A) Filter the RF noise floor
- B) Stabilize and control the output frequency
- C) Convert RF to baseband
- D) Increase antenna gain

Answer: B) Stabilize and control the output frequency

Explanation: PLLs compare the output frequency with a reference and adjust a voltage-controlled oscillator (VCO) to lock it, providing precise, stable frequencies for RF systems.

Q79. The **Noise Figure (NF)** of a receiver is measured in:

- A) dBm
- B) dBc
- C) dB
- D) Hz

Answer: C) dB

Explanation: Noise figure is a dimensionless ratio (output SNR / input SNR) expressed in decibels. Lower NF means better sensitivity.

Q80. Which feed type is most commonly used in parabolic dish antennas for satellite communication?

- A) Coaxial feed
- B) Cassegrain feed
- C) End-fed loop
- D) Slotted waveguide feed

Answer: B) Cassegrain feed

Explanation: Cassegrain feeds use a sub-reflector to shorten feed line length and improve efficiency, making them common in satellite earth stations.

Q81. For an HF multi-band wire antenna, what method is often used to achieve multi-band operation?

- A) Using multiple LNAs
- B) Adding loading coils and traps
- C) Reducing antenna height
- D) Increasing feed line length

Answer: B) Adding loading coils and traps

Explanation: Traps and coils allow different sections of the antenna to resonate at different frequencies, enabling multi-band operation without multiple antennas.

Q82. Which measurement instrument is primarily used to determine antenna return loss and impedance?

- A) Spectrum Analyzer
- B) Vector Network Analyzer (VNA)
- C) Oscilloscope
- D) Frequency Counter

Answer: B) Vector Network Analyzer (VNA)

Explanation: VNAs measure S-parameters, including S11 (reflection coefficient), which determines return loss, VSWR, and impedance matching.

Q83. A **patch antenna** is most suitable for:

- A) Ultra-wideband communication
- B) Low-profile applications like GPS receivers
- C) High-power radar transmitters
- D) Long-wave maritime communication

Answer: B) Low-profile applications like GPS receivers

Explanation: Patch antennas are compact, low-profile, and suitable for portable and mobile applications, but generally narrowband.

Q84. Which RF component combines signals from multiple transmitters into a single output path?

- A) Coupler
- B) Splitter
- C) Power Combiner
- D) Duplexer

Answer: C) Power Combiner

Explanation: A power combiner merges signals from different sources for transmission through a single antenna or feed line.

Q85. In a narrowband microwave filter, the **loaded Q-factor** is:

- A) Directly proportional to bandwidth
- B) Inversely proportional to bandwidth
- C) Independent of bandwidth
- D) Equal to insertion loss

Answer: B) Inversely proportional to bandwidth

Explanation: $Q_L = f_0 / BW$ — a higher Q means narrower bandwidth and sharper selectivity.

Q86. The main advantage of **omnidirectional antennas** in mobile base stations is:

- A) High gain in a specific direction
- B) Coverage in all horizontal directions
- C) High resistance to multipath fading
- D) Lower manufacturing cost

Answer: B) Coverage in all horizontal directions

Explanation: Omni antennas provide uniform coverage around the tower, making them suitable for serving users in all directions.

Q87. Which antenna type can easily achieve **wideband performance**?

- A) Yagi-Uda
- B) Log-periodic Dipole Array
- C) Patch antenna
- D) Helical antenna in axial mode

Answer: B) Log-periodic Dipole Array

Explanation: Log-periodic antennas have self-similar elements with varying lengths, enabling consistent impedance over a wide frequency range.

Q88. In an RF receiver, image frequency is an unwanted signal because:

- A) It increases noise floor
- B) It appears at the same IF as the desired signal after mixing
- C) It distorts the modulation
- D) It increases power consumption

Answer: B) It appears at the same IF as the desired signal after mixing

Explanation: Without proper pre-selection filtering, the image frequency can be down-converted to the same IF, causing interference.

Q89. Which simulation tool is most often used for **antenna pattern analysis** in 3D electromagnetic modeling?

- A) ADS
- B) CST Microwave Studio
- C) MATLAB
- D) LabVIEW

Answer: B) CST Microwave Studio

Explanation: CST is widely used for full-wave 3D electromagnetic simulations, especially for antennas and complex microwave structures.

Q90. The **gain** of an antenna is a function of:

- A) Directivity and efficiency
- B) Bandwidth and VSWR
- C) Height above ground
- D) Feed line loss

Answer: A) Directivity and efficiency

Explanation: Gain combines directivity (how well it focuses energy) and efficiency (how much input power is radiated).

Q91. The **beamwidth** of a parabolic reflector antenna decreases when:

- A) Dish diameter increases
- B) Dish diameter decreases
- C) Frequency decreases
- D) Feed horn gain decreases

Answer: A) Dish diameter increases

Explanation: Larger apertures focus energy more tightly, reducing beamwidth and increasing gain.

Q92. Which matching technique is commonly used in microstrip patch antennas?

- A) $\lambda/4$ transformer
- B) Balun transformer
- C) Waveguide iris coupling
- D) Diplexer matching

Answer: A) $\lambda/4$ transformer

Explanation: A quarter-wave transformer can match the antenna feed impedance to the transmission line for optimal power transfer.

Q93. Why is a **low-noise figure** critical for satellite receivers?

- A) To allow higher transmit power
- B) To minimize the degradation of weak signals
- C) To avoid frequency drift
- D) To improve antenna gain

Answer: B) To minimize the degradation of weak signals

Explanation: Satellite signals are weak due to long distances, so minimizing receiver NF preserves the signal quality.

Q94. Which type of antenna polarization is most resistant to multipath fading in urban areas?

- A) Linear
- B) Circular

- C) Elliptical
- D) Slant

Answer: B) Circular

Explanation: Circular polarization reduces the effect of reflections changing the signal polarization, improving link reliability.

Q95. In a microwave link, **rain fade** primarily affects:

- A) LF and MF bands
- B) VHF and UHF bands
- C) SHF and EHF bands
- D) HF and VLF bands

Answer: C) SHF and EHF bands

Explanation: Rain attenuation is significant above ~10 GHz, affecting satellite Ku, Ka, and higher bands.

Q96. What is the main role of a **directional coupler** in RF measurement?

- A) To split signals equally
- B) To isolate input and output
- C) To sample a portion of the signal without disturbing the main path
- D) To convert RF to baseband

Answer: C) To sample a portion of the signal without disturbing the main path

Explanation: Directional couplers allow measurement of forward/reflected power without interrupting the transmission.

Q97. Which parameter defines the usable range of frequencies for an antenna?

- A) Directivity
- B) Bandwidth
- C) Gain
- D) Beamwidth

Answer: B) Bandwidth

Explanation: Bandwidth defines the frequency range over which the antenna meets performance specifications (VSWR, gain, radiation pattern).

Q98. In VLF communication, large antenna sizes are required because:

- A) Higher gain is needed
- B) Wavelengths are very long
- C) More bandwidth is available
- D) Polarization changes rapidly

Answer: B) Wavelengths are very long

Explanation: VLF wavelengths can be tens of kilometers, so electrically small antennas require large physical sizes to be efficient.

Q99. Which of the following can be used for **dual-polarized antenna designs**?

- A) Two orthogonal dipoles
- B) A single patch with slots
- C) Two feed points at 90°
- D) All of the above

Answer: D) All of the above

Explanation: Dual polarization can be achieved through multiple techniques, including orthogonal dipoles, patch modifications, and dual feeds.

Q100. Which parameter is most directly measured when using a horn antenna in an anechoic chamber?

- A) Radiation efficiency
- B) Return loss
- C) Radiation pattern and gain
- D) Input impedance

Answer: C) Radiation pattern and gain

Explanation: Horn antennas are often used as reference antennas in anechoic chambers to measure radiation characteristics of test antennas.