Electronics SET 1

1. (Digital Electronics) Which of the following Boolean expressions is equivalent to $\overline{A}B + A\overline{B}$?

   A) $A + B$

   B) $A \oplus B$

   C) AB

   D) $\overline{A + B}$

   Answer: B) $A \oplus B$

   Explanation: $\overline{A}B + A\overline{B}$ is the XOR function.

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2. (Network Circuits & Systems) For an ideal op-amp in an inverting amplifier configuration with R_in = 10 kΩ and R_f = 100 kΩ, the voltage gain is:

   A) -1

   B) -10

   C) +10

   D) -0.1

   Answer: B) -10

   Explanation: Inverting gain = -R_f/R_in = -100k/10k = -10.

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3. (Analog Devices & Circuits) Which characteristic of a BJT in the forward-active region is true?

   A) Collector current independent of base-emitter voltage

   B) Collector current primarily controlled by base-emitter voltage (exponential)

   C) Collector-emitter behaves as an open circuit

   D) Base current equals collector current

   Answer: B

   Explanation: In forward-active, $I_C \approx I_S e^{V_{BE}/V_T}$ (exponential relation).

4. (Microprocessor & Microcontroller) In 8085 microprocessor, the instruction MOV A, M copies:
   A) Memory at address in HL to A
   B) Content of stack pointer to A
   C) Content of immediate data to A
   D) Content of register M to A
   Answer: A
   Explanation: In 8085, M refers to memory addressed by HL pair.

5. (Communication Systems) Nyquist criterion for zero ISI in baseband requires the pulse to satisfy:
   A) $H(f) = 0$ at multiples of symbol rate
   B) $\sum_{k=-\infty}^{\infty} p(nT_s - kT_s) = 1$
   C) $p(nT_s) = 0$ for all integer n ≠ 0
   D) Constant envelope modulation
   Answer: C
   Explanation: Zero ISI requires sampled pulse values at symbol intervals be zero except at 0.

6. (Basic Electronics) A Zener diode in breakdown used as regulator—what parameter primarily determines regulation quality?
   A) Zener knee current only
   B) Dynamic resistance in breakdown region
   C) Forward voltage drop
   D) Avalanche temperature coefficient only
   Answer: B
   Explanation: Low dynamic (differential) resistance gives better voltage regulation.

7. (Semiconductor Devices) In a MOSFET, the subthreshold (weak inversion) region conduction depends exponentially on:
   A) Vds only

B) Vgs only
C) Vgs and temperature
D) Gate oxide thickness only
Answer: C
Explanation: Subthreshold current ~ exp(qVgs/(nkT)); depends on Vgs and temperature.

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8. (Satellite Communication) GEO satellites appear stationary because their orbital period equals:
A) One sidereal day (~23h56m)
B) One solar day (24 h)
C) One lunar day
D) One year
Answer: A
Explanation: GEO orbital period equals Earth's sidereal rotation (~23h56m), appearing fixed relative to stars and ground.

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9. (Antenna & Microwave) For a half-wave dipole, the radiation resistance is approximately:
A) 2 Ω
B) 73 Ω
C) 300 Ω
D) 50 Ω
Answer: B) 73 Ω
Explanation: Half-wave dipole characteristic radiation resistance ~ 73 Ω.

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10. (VLSI) In CMOS static CMOS inverter, which path conducts during switching from 0→1 (input low→high)?
A) Pull-up PMOS off, NMOS off
B) PMOS conducts then NMOS conducts, brief both conduct causing short-circuit current
C) Only PMOS conducts forever
D) There is no overlap conduction
Answer: B

Explanation: During transition both may conduct briefly causing short-circuit current.

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11. (Embedded Systems) RTOS priority inversion problem occurs when:

A) A low-priority task holds a resource needed by a high-priority task while a medium-priority preempts both
B) High-priority task waits for I/O forever
C) All tasks have same priority
D) Preemption disabled
Answer: A
Explanation: Priority inversion: low holds resource, medium preempts, blocking high-priority indirectly.

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12. (PLC) A ladder logic rung with an NO contact in series with an NC contact controlling a coil implements:
A) AND with inversion on first input
B) A conditional AND where second input is active-low
C) OR function
D) XOR function
Answer: B
Explanation: Series is logical AND; NC contact means active when input is false → implements AND with second active-low.

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13. (Power Electronics) In a single-phase full-controlled bridge rectifier feeding a resistive load, if firing angle $\alpha>90°$, the average output becomes:
A) Positive still
B) Negative
C) Zero
D) Maximum at $\alpha=180°$
Answer: A
Explanation: For resistive load, average

$V_{dc} = \frac{2V_m}{\pi} \cos \alpha$. For $\alpha > 90°$, $\cos\alpha$ negative → average negative

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14. (Computer Networking) Which protocol uses a three-way handshake to establish a reliable connection?
    A) UDP
    B) TCP
    C) ICMP
    D) ARP
    Answer: B) TCP
    Explanation: TCP uses SYN, SYN-ACK, ACK handshake for connection establishment.

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15. (MATLAB) In MATLAB, which function computes eigenvalues of matrix A?
    A) solve(A)
    B) eig(A)
    C) roots(A)
    D) ev(A)
    Answer: B) eig(A)
    Explanation: eig returns eigenvalues (and optionally eigenvectors) of matrix A.

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16. (Digital) A 4-bit ripple carry adder built from full adders has worst-case carry propagation delay proportional to:
    A) 1 (constant)
    B) log2(n)
    C) n (number of bits)
    D) n^2
    Answer: C) n
    Explanation: Ripple carry worst-case delay grows linearly with number of bits since carries propagate through each full adder.

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17. (Network Circuits) In an RLC series resonant circuit, at resonance the impedance is:
A) Maximum
B) Minimum (equal to R)
C) Purely capacitive
D) Infinite
Answer: B
Explanation: At resonance XL = XC so reactive parts cancel; impedance = R (minimum).

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18. (Analog Devices) A differential amplifier rejects common-mode signals defined by:
A) Common-mode gain
B) Differential gain
C) Common-mode rejection ratio (CMRR) — higher is better
D) Input bias current
Answer: C
Explanation: CMRR = Ad / Ac measures the amplifier's ability to reject common-mode inputs; higher = better.

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19. (Microcontroller) In ARM Cortex-M, the instruction set is:
A) x86
B) MIPS
C) Thumb/Thumb-2 (32/16 bit mixed)
D) PowerPC
Answer: C
Explanation: Cortex-M uses Thumb/Thumb-2 compressed instruction set.

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20. (Communication) In QPSK, the spectral efficiency compared to BPSK is:
A) Half
B) Same
C) Twice
D) Four times
Answer: C) Twice

Explanation: QPSK transmits 2 bits per symbol vs 1 for BPSK → double spectral efficiency.

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21. (Basic Electronics) A capacitor in AC steady-state blocks:
    A) DC, passes AC (impedance decreases with frequency)
    B) AC, passes DC
    C) Both equally
    D) Neither
    Answer: A
    Explanation: Capacitor impedance XC = 1/(2πfC), at DC f=0 → infinite impedance (blocks DC).

---

22. (Semiconductor Devices) Reverse recovery time of a diode affects:
    A) Conduction losses only
    B) Switching losses and stresses in high-frequency rectifiers
    C) Forward voltage only
    D) Threshold voltage
    Answer: B
    Explanation: Slow reverse recovery causes extra charge removal, increasing switching losses and voltage spikes.

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23. (Satellite Comm) Link budget includes all EXCEPT:
    A) Transmit power
    B) Path loss
    C) Antenna gains
    D) Processor clock speed
    Answer: D
    Explanation: Processor speed not part of RF link budget.

---

24. (Antenna) A patch antenna is typically:
    A) Narrowband, planar, used in microstrip form for WLAN/GPS
    B) Very broadband with omnidirectional pattern only
    C) Used only for HF bands
    D) Not suitable for PCB implementation

Answer: A
Explanation: Microstrip patch antennas are planar, narrow-to-moderate bandwidth, common in WLAN/GPS.

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25. (VLSI) Which scaling gives improved transistor switching speed and lower capacitance as technology scales (Dennard scaling)?
A) Constant voltage scaling
B) Constant field scaling
C) No scaling
D) Reverse scaling
Answer: B) Constant field scaling
Explanation: Constant electric field scaling reduces dimensions, voltages, improving speed and reducing capacitance (Dennard).

---

26. (Embedded) DMA (Direct Memory Access) is used to:
A) Let CPU directly access peripheral registers only
B) Allow peripherals to read/write memory without CPU intervention
C) Replace ALU in CPU
D) Increase interrupt rate
Answer: B
Explanation: DMA moves data between memory and peripherals bypassing CPU for efficiency.

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27. (PLC) Modbus is primarily used as:
A) Programming language for PLCs
B) Industrial communication protocol in SCADA/PLC systems
C) Analog signal conditioning method
D) Safety standard
Answer: B
Explanation: Modbus is a common serial/TCP protocol for PLC and SCADA communications.

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28. (Power Electronics) SiC MOSFET advantages over Si include:
A) Lower switching losses, higher temperature operation, higher

breakdown field
B) Higher gate charge only
C) Lower thermal conductivity
D) Lower bandgap
Answer: A
Explanation: SiC has wider bandgap → higher breakdown, higher temp operation, lower switching losses.

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29. (Computer Networking) CIDR notation 192.168.0.0/22 denotes what subnet mask?
A) 255.255.255.0
B) 255.255.252.0
C) 255.255.240.0
D) 255.255.255.192
Answer: B) 255.255.252.0
Explanation: /22 means 22 ones → mask 255.255.252.0.

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30. (MATLAB) To solve linear system Ax=b, the most recommended (numerically stable) MATLAB operation is:
A) inv(A)*b
B) A\b
C) pinv(A)
D) multiply(A,b)
Answer: B) A\b
Explanation: Backslash operator uses optimized factorization (LU/QR) and is more stable than explicitly using inv(A).

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31. (Digital) Karnaugh maps are best for simplifying logic up to how many variables before they become unwieldy?
A) 2
B) 4–6 variables
C) 10+ variables easily
D) Only 3 variables
Answer: B

Explanation: K-maps are practical up to 4–6 variables; beyond that algebraic or algorithmic methods preferred.

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32. (Network Circuits) A transmission line is said to be lossless when:
A) R=0 and G=0 (series resistance and shunt conductance zero)
B) L=0, C=0
C) Characteristic impedance = 0
D) Wave velocity → 0
Answer: A
Explanation: Lossless transmission line assumes R=0 and G=0, leaving L and C.

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33. (Analog Devices) The Miller effect in amplifiers increases:
A) Input capacitance (effective) due to feedback between input and output
B) Output resistance
C) Bandwidth
D) Supply voltage
Answer: A
Explanation: Miller effect multiplies capacitance between input and output by gain, increasing effective input capacitance and reducing bandwidth.

---

34. (Microcontroller) In PIC microcontrollers, the Program Counter increments after:
A) Every instruction cycle (depends on instruction length)
B) After two instruction cycles always
C) Only on branch instructions
D) Never
Answer: A (depends on architecture)
Explanation: Program Counter increments according to instruction size and fetch cycle; short-answer: after each instruction fetch; specifics vary by PIC family.

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35. (Communication) Which error-correcting code can both detect and correct single-bit errors and detect double-bit errors?
A) Parity bit
B) Hamming code (single-error-correcting, double-error-detecting)
C) CRC-32
D) Repetition code
Answer: B
Explanation: Hamming code can correct single-bit and detect (but not correct) double-bit errors (SEC-DED variants).

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36. (Basic Electronics) In a transistor biasing network, thermal runaway is prevented by:
A) Positive feedback
B) Negative feedback and proper bias stabilization (emitter resistor)
C) Increasing supply voltage
D) Using larger base resistor only
Answer: B
Explanation: Emitter resistor provides negative feedback reducing change of current with temp → helps thermal stability.

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37. (Semiconductor Devices) A Gunn diode is used for:
A) DC regulation
B) Microwave oscillators (negative resistance device)
C) Power rectification
D) Optical detection
Answer: B
Explanation: Gunn diode exploits transferred electron effect in GaAs to produce microwave oscillations.

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38. (Satellite) Rain fade affects which band most severely?
A) L-band
B) C-band
C) Ku and Ka bands (higher frequencies)
D) VLF
Answer: C

Explanation: Higher frequency bands (Ku/Ka) suffer more attenuation due to rain.

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39. (Antenna & Microwave) S-parameters are measured in microwave circuits because:
A) Voltage and current hard to measure at high frequency; S-parameters use incident/reflected waves
B) They are trivial to compute only for DC
C) They only apply to optical fiber
D) They measure mechanical resonance
Answer: A
Explanation: S-parameters convenient at RF since they use power-wave representation and 50Ω reference.

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40. (VLSI) Static power in deep-submicron CMOS increases mainly due to:
A) Dynamic switching only
B) Subthreshold leakage and gate oxide tunneling (leakage currents)
C) Larger geometries
D) Lower temperatures
Answer: B
Explanation: Leakage mechanisms (subthreshold, gate oxide tunneling) increase static power as transistors scale.

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41. (Embedded) Watchdog timer primarily used to:
A) Speed up CPU
B) Recover system from software hang by resetting MCU if not serviced
C) Provide power regulation
D) Increase ROM capacity
Answer: B
Explanation: If software fails to reset watchdog periodically, watchdog triggers reset to recover system.

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42. (PLC) In PID loop implemented in PLC for temperature control, the integral term:

A) Responds to rate of error change
B) Eliminates steady-state error by accumulating error over time
C) Only amplifies noise
D) Prevents oscillations always
Answer: B
Explanation: Integral term integrates error over time to reduce steady-state error; can cause windup if unchecked.

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43. (Power Electronics) In PWM inverter, switching frequency should be:
A) Much lower than desired output fundamental frequency
B) Much higher than desired fundamental to ease filtering and reduce harmonics
C) Equal to DC link voltage
D) Irrelevant
Answer: B
Explanation: High switching frequency shifts switching harmonics to higher frequencies easier to filter.

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44. (Computer Networking) OSPF is classified as which routing protocol type?
A) Distance-vector
B) Link-state
C) Path-vector
D) Reactive
Answer: B) Link-state
Explanation: OSPF builds link-state database and uses Dijkstra to compute shortest paths.

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45. (MATLAB) Which MATLAB construct is best for pre-allocating a large numeric array to enhance speed?
A) Declare without size, then append inside loop
B) zeros(n,m) or preallocating functions
C) Use cell array always
D) Use global variables
Answer: B

Explanation: Preallocating arrays with zeros/ones avoids repeated resizing slowing loops.

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46. (Digital) A synchronous counter with asynchronous clear—what is a drawback of asynchronous clear?
A) It is slower than synchronous clear
B) Causes glitching due to propagation differences across flip-flops
C) Requires more power
D) Can't be used with JK flip-flops
Answer: B
Explanation: Asynchronous signals reach flip-flops at different times leading to transient invalid states (glitches).

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47. (Network Circuits) Thevenin equivalent of a network is useful because:
A) It reduces complex network to single source & series impedance for analysis of load behavior
B) It increases network complexity
C) It only applies to nonlinear circuits
D) It is used to design antennas
Answer: A
Explanation: Thevenin theorem simplifies linear networks for load analysis.

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48. (Analog Devices) A class AB amplifier is chosen over class B primarily to:
A) Increase distortion
B) Reduce crossover distortion of class B while maintaining efficiency better than class A
C) Maximize power consumption
D) Avoid need for biasing
Answer: B
Explanation: Class AB biases output devices slightly ON to reduce crossover distortion with reasonable efficiency.

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49. (Microprocessor) In pipelining, structural hazard occurs when:
A) Two instructions require the same hardware resource simultaneously
B) Instruction fetch fails
C) Data forwarding used
D) Branch prediction perfect
Answer: A
Explanation: Structural hazards are resource conflicts; solved by resource duplication or stalling.

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50. (Communication) For a channel with bandwidth B and SNR, Shannon capacity is C = B log2 (1+SNR). To double capacity without changing SNR, you must:
A) Half bandwidth
B) Double bandwidth
C) Reduce noise
D) Increase modulation order only
Answer: B
Explanation: Capacity proportional to B; doubling B doubles capacity for same SNR.

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51. (Basic Electronics) A Wheatstone bridge measures:
A) Capacitance only
B) Inductance only
C) Unknown resistance with high sensitivity by balancing bridge
D) Frequency
Answer: C
Explanation: Balanced Wheatstone used to measure unknown resistance precisely.

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52. (Semiconductor Devices) MOSFET breakdown voltage mainly determined by:
A) Gate oxide thickness only
B) Drain-body junction doping and drift region geometry
C) Source resistance
D) Gate threshold only

Answer: B
Explanation: Breakdown determined by device doping/profile especially in high-voltage MOSFETs.

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53. (Satellite) TWT (Traveling Wave Tube) used on satellite transponders is:
A) A low-power digital IC
B) High-power microwave amplifier with broad bandwidth
C) A type of antenna
D) Not used in space due to vacuum requirement
Answer: B
Explanation: TWTAs provide high-power amplification at microwave frequencies and are used in satellites.

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54. (Antenna) Increasing antenna aperture generally:
A) Reduces gain
B) Increases directivity and gain
C) Has no effect on pattern
D) Only affects impedance
Answer: B
Explanation: Larger effective aperture (for given wavelength) increases directivity/gain.

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55. (VLSI) Clock skew in synchronous VLSI design can cause:
A) Faster operation always
B) Setup or hold time violations leading to incorrect operation
C) Gate oxide breakdown
D) None, it's desirable
Answer: B
Explanation: Skew causes arrival time differences possibly violating setup/hold constraints.

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56. (Embedded) Little-endian vs big-endian refers to:
A) Floating point format only
B) Byte order of multi-byte data in memory

C) Instruction set only
D) ADC sample order
Answer: B
Explanation: Endianness defines whether least-significant byte stored at lowest memory address (little-endian) or highest (big-endian).

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57. (PLC) In contact ladder logic, a seal-in circuit is used to:
A) Debounce inputs only
B) Hold an output ON after the activating input is released (latching)
C) Connect to analog sensors
D) Provide high-voltage output
Answer: B
Explanation: Seal-in uses parallel contact of output to latch the rung.

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58. (Power Electronics) Gate drive for IGBT frequently includes a Miller clamping resistor to:
A) Increase switching speed always
B) Prevent unintended turn-on during dv/dt by limiting Vge during Miller plateau
C) Replace gate resistor function entirely
D) Provide energy storage
Answer: B
Explanation: Proper gate clamping avoids false triggering from dV/dt across collector-emitter.

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59. (Computer Networking) Which transport layer feature provides multiplexing of multiple application flows on single host?
A) IP addressing
B) Port numbers (TCP/UDP)
C) MAC addressing
D) DNS
Answer: B
Explanation: Ports identify application endpoints, allowing multiple flows.

60. (MATLAB) To plot multiple curves on same axes without overwriting in MATLAB, use:
A) plot(x,y); plot(x2,y2) — successive calls overwrite by default unless hold on used
B) Use subplot always
C) Use figure every time
D) Use hold on before second plot call or pass multiple (x,y,x2,y2) to plot
Answer: D
Explanation: Either use hold on or pass multiple pairs to plot to display multiple curves.

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61. (Digital) A Johnson counter of n flip-flops has period:
A) 2^n
B) 2n
C) n
D) n/2
Answer: B) 2n
Explanation: Johnson (twisted ring) counter cycles through 2n unique states.

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62. (Network Circuits) Impedance matching maximizes power transfer when load equals:
A) Zero
B) Source internal impedance conjugate (complex conjugate)
C) Twice source impedance always
D) Infinity
Answer: B
Explanation: Maximum power transfer theorem: for complex impedances, load = complex conjugate of source impedance.

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63. (Analog Devices) A Schmitt trigger input hysteresis prevents:
A) DC conduction
B) Oscillations or chatter with slowly varying/noisy inputs by having two

thresholds
C) Amplifier biasing
D) Changing output polarity
Answer: B
Explanation: Hysteresis introduces different thresholds for rising/falling input to avoid oscillation due to noise.

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64. (Microprocessor) Cache memory improves performance by:
A) Increasing bus width only
B) Storing frequently used data/instructions closer to CPU to reduce access latency
C) Decreasing clock rate
D) Eliminating main memory
Answer: B
Explanation: Cache reduces average memory access time by exploiting temporal/spatial locality.

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65. (Communication) In OFDM systems, subcarrier orthogonality is achieved by spacing subcarriers at:
A) Arbitrary frequencies
B) Multiples of symbol rate (1/T) so they are orthogonal over symbol duration
C) Equal to carrier frequency only
D) Random frequencies
Answer: B
Explanation: Subcarriers spaced at 1/T (symbol rate) guarantee orthogonality.

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66. (Basic Electronics) A temperature sensor LM35 gives output proportional to:
A) Current only
B) Voltage proportional to Celsius (10 mV/°C)
C) Resistance only
D) Frequency only

Answer: B
Explanation: LM35 outputs 10 mV per °C (approx).

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67. (Semiconductor Devices) Avalanche breakdown occurs when:
A) Carriers recombine only
B) High electric field accelerates carriers causing impact ionization generating more carriers
C) Temperature reaches absolute zero
D) Forward bias small
Answer: B
Explanation: High field causes impact ionization leading to avalanche multiplication.

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68. (Satellite) GEO satellite altitude approximately:
A) 35786 km above Earth's surface
B) 1000 km
C) 200 km
D) 10,000 km
Answer: A
Explanation: Geostationary orbit altitude ~35,786 km.

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69. (Antenna) The Friis transmission equation applies to:
A) Near-field only
B) Far-field line-of-sight power transfer between antennas with known gains and separation
C) Fiber optics only
D) DC power transmission
Answer: B
Explanation: Friis relates received power to transmitted power, gains, wavelength, and distance in far-field.

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70. (VLSI) In static timing analysis, slack is:
A) Difference between required arrival time and actual arrival time (positive slack = safe margin)

B) Gate capacitance
C) Clock skew only
D) Power consumption per gate
Answer: A
Explanation: Slack indicates timing margin: positive OK; negative means timing violation.

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71. (Embedded) A binary semaphore used for mutual exclusion must be:
A) Always busy-waiting
B) Acquired and released properly to avoid deadlocks; blocking semaphores preferred to avoid busy-wait
C) Stored in EEPROM only
D) Used for floating point operations
Answer: B
Explanation: Semaphores control access; binary semaphores can implement mutexes; blocking avoids CPU waste.

---

72. (PLC) Analog modules in PLCs typically use which format?
A) Discrete on/off only
B) 4–20 mA or 0–10V signals for sensors/actuators in industrial settings
C) Only RS-232 serial
D) Bluetooth only
Answer: B
Explanation: 4–20 mA and 0–10 V standard industrial analog signal ranges.

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73. (Power Electronics) In a single-phase full-wave uncontrolled rectifier with large smoothing capacitor and resistive load, output DC ripple frequency equals:
A) Input frequency
B) Twice input frequency
C) Half input frequency
D) Same as switching frequency always
Answer: B

Explanation: Full-wave rectifier pulses at 2× line frequency; smoothing capacitor sees ripple at twice mains.

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74. (Computer Networking) Spanning Tree Protocol (STP) prevents:
A) Routing loops in IP networks
B) Switching loops at Data Link layer by disabling redundant links to form a loop-free tree
C) VLAN misconfiguration
D) Firewall bypass
Answer: B
Explanation: STP blocks redundant switch ports to avoid broadcast storms and loops.

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75. (MATLAB) Which command in MATLAB provides help for function fft?
A) info fft
B) help fft
C) man fft
D) profft
Answer: B
Explanation: help function returns usage and info in MATLAB.

---

76. (Digital) A finite state machine has Mealy vs Moore models — Mealy outputs depend on:
A) State only
B) State and input (possible faster response)
C) Clock only
D) Reset only
Answer: B
Explanation: Mealy outputs depend on state and current inputs; Moore depend only on state.

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77. (Network Circuits) For maximum power transfer in AC circuits, you match:
A) Real part only

B) Impedance to complex conjugate of source impedance
C) Both zero
D) Don't match anything
Answer: B
Explanation: Complex conjugate matching ensures maximum real power transfer.

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78. (Analog Devices) For OTA (Operational Transconductance Amplifier), the output is:
A) Voltage proportional to input voltage always
B) Current proportional to input differential voltage (transconductance gm programmable)
C) Power proportional to time
D) Inductance proportional to frequency
Answer: B
Explanation: OTA outputs current = gm * (V+ - V-); gm controllable by bias current.

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79. (Microprocessor) In memory-mapped I/O, I/O devices are accessed via:
A) Special in/out instruction only
B) Memory address space; peripherals have assigned addresses; CPU uses same load/store instructions
C) Only DMA channels
D) No addressing required
Answer: B
Explanation: Memory-mapped I/O treats device registers as memory addresses.

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80. (Communication) A matched filter maximizes SNR at sampling instant because it:
A) Minimizes energy
B) Correlates received signal with time-reversed replica of transmitted pulse to maximize SNR in AWGN
C) Is easiest to implement always
D) Only works with FM

Answer: B
Explanation: Matched filter maximizes output SNR for known pulse in white Gaussian noise.

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81. (Basic Electronics) A potentiometer used as a variable voltage divider has three terminals; using only two terminals makes it behave as:
A) Fixed resistor (wiper and one end)
B) Capacitor
C) Diode
D) Inductor
Answer: A
Explanation: Using two terminals (end and wiper) selects a variable resistance portion; behaves as a variable resistor.

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82. (Semiconductor Devices) Fowler–Nordheim tunneling in MOS devices is significant when:
A) Gate oxide thick
B) Gate electric field very high (thin oxide, high V) causing electrons tunnel through oxide
C) At very low temperatures only
D) When device off only
Answer: B
Explanation: High field across very thin oxides leads to FN tunneling leakage.

---

83. (Satellite) GEO satellite spacing in longitude must consider:
A) No spacing needed
B) Station-keeping and interference — typical separations depend on beamwidth and coordination agreements (a few degrees)
C) Only altitude matters
D) Satellites cannot share orbital slots
Answer: B
Explanation: Orbital separation and coordination prevent interference; typical separations depend on coverage and frequency reuse.

84.(Antenna) An array factor depends on:
A) Individual element pattern only
B) Geometry, element spacing, and relative phase/amplitude excitation of elements
C) Transmission line length only
D) Color of antenna
Answer: B
Explanation: Array factor determined by positions and excitations; total pattern = element pattern × array factor.

85.(VLSI) HSPICE is primarily used for:
A) Functional programming
B) Detailed transistor-level circuit simulation (analog/RF timing/power analysis)
C) PCB layout only
D) DNA sequencing
Answer: B
Explanation: HSPICE is a SPICE engine for transistor-level simulations.

86.(Embedded) Flash memory endurance is limited by:
A) Read cycles only
B) Number of write/erase cycles (limited endurance)
C) Clock speed only
D) Power only
Answer: B
Explanation: Flash cells degrade after many program/erase cycles; wear-leveling used to extend lifetime.

87.(PLC) Safety PLC differs from standard PLC because:
A) It has redundant and certified safety functions, and meets safety standards (SIL/PL)
B) It's always slower
C) Only supports analog I/O

D) Uses thermal fuses
Answer: A
Explanation: Safety PLCs are designed and certified for safety-critical control with redundancy and diagnostics.

88.(Power Electronics) Snubber R-C across a switch primarily damps:
A) Continuous conduction mode only
B) Voltage spikes due to switching transients and limit dv/dt
C) DC offset only
D) Gate charge only
Answer: B
Explanation: RC snubbers absorb transient energy reducing voltage overshoot and dv/dt.

89.(Computer Networking) BGP is characterized as:
A) Interior Gateway Protocol (IGP) only
B) Exterior Gateway Protocol used between autonomous systems (path-vector protocol)
C) Link-layer protocol
D) Realtime streaming protocol
Answer: B
Explanation: BGP exchanges reachability between ASes, uses path-vector attributes.

90.(MATLAB) Which function gives polynomial roots given coefficient vector p?
A) solve(p)
B) polyroot(p)
C) roots(p)
D) eig(p)
Answer: C) roots(p)
Explanation: roots(p) returns roots of polynomial with coefficient vector p.

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91. (Digital) Carry-lookahead adder reduces addition delay by computing:
A) Carry sequentially only
B) Generate and propagate signals to compute carries in parallel reducing dependence on ripple
C) Using larger transistors only
D) Using multiplication
Answer: B
Explanation: CLA computes carry lookahead using generate/propagate to speed up addition.

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92. (Network Circuits) A band-pass filter implemented with RLC has center frequency $f0 = 2\pi LC1$. If L decreased by factor 4, f0 changes by:
A) halves
B) doubles
C) quadruples
D) unchanged
Answer: B) doubles
Explanation: $f0 \propto 1/\sqrt{L}$; reducing L by 4 increases f0 by $\sqrt{4} = 2$.

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93. (Analog Devices) A current mirror replicates:
A) Voltage precisely
B) A reference current to copy it into other branches (assuming high output resistance)
C) Frequency only
D) Power factor
Answer: B
Explanation: Current mirror forces same current through output transistor proportional to reference.

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94. (Microprocessor) Memory hierarchy benefits from spatial locality when:
A) Programs access memory addresses randomly only
B) When accessing a memory address, nearby addresses likely to be accessed soon (prefetching helps)
C) Only used by GPUs
D) Only for I/O devices

Answer: B
Explanation: Spatial locality means accessing nearby addresses; caches prefetch/line-based storage exploit it.

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95. (Communication) Spread spectrum direct-sequence (DSSS) improves resistance to:
A) Thermal noise only
B) Narrowband interference and provides low probability of intercept due to spreading
C) Static DC offset only
D) None
Answer: B
Explanation: DSSS spreads signal over wide band making it robust to narrowband jamming and stealthier.

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96. (Basic Electronics) RC low-pass filter cutoff frequency $f_c = 1/(2\pi RC)$. If R doubled, fc:
A) Doubles
B) Halves
C) Quadruples
D) Unchanged
Answer: B
Explanation: $f_c \propto 1/(RC)$, doubling R halves cutoff frequency.

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97. (Semiconductor Devices) Bandgap engineering allows:
A) Alteration of semiconductor bandgap by changing material composition to tune electrical/optical properties
B) Only used for resistors
C) Removing bandgap entirely always
D) Reduce cost always
Answer: A
Explanation: Alloying (e.g., AlGaAs) adjusts bandgap for devices like LEDs, HBTs.

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98. (Power Electronics) In a three-phase full-wave rectifier with continuous current, the DC output ripple frequency equals:
A) 3 times line frequency
B) 6 times line frequency
C) Same as line frequency
D) Twice line frequency
Answer: B) 6 times line frequency
Explanation: For 3-phase bridge, ripple pulsations occur at 6× mains frequency (6-pulse rectification).

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99. (Computer Networking) TCP congestion control uses which of the following phases?
A) Slow start, congestion avoidance, fast retransmit, fast recovery
B) Only slow start
C) No congestion control
D) Only AIMD without slow start
Answer: A
Explanation: TCP Tahoe/Reno variants implement these phases; AIMD underlies congestion avoidance.

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100. (MATLAB) To create a sparse matrix S from dense matrix A for memory efficiency, use:
A) sparse(A)
B) zeros(size(A))
C) full(A)
D) dense(A)
Answer: A) sparse(A)
Explanation: sparse converts dense to sparse format storing only nonzero elements, memory efficient for large sparse matrices.