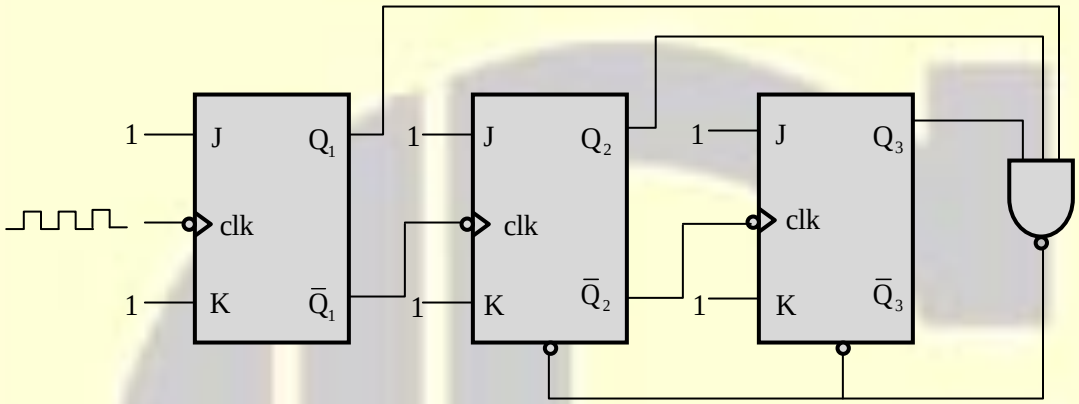
1. The approximate output frequency of 555 oscillator for $R_A = R_B = 2.2\ k\Omega$ and $C = 2000\ pF$ is

(A) 110 kHz (B) 109.3 kHz (C) 120.5 kHz (D) 108.9 kHz

---

2. A counter is designed using JK flip-flop as shown in the figure. Define its count sequence.



(A) 000, 001, 010, 011, 100 and repeats

(B) 100, 011, 010, 001, 000 and repeats

(C) 010, 011, 100, 000, 001 and repeats

(D) 101, 110, 111, 000, 001, 010, 011, 100 and repeats

---

3. A 1 MHz clock signal is applied to a JK flip-flop with J = K = 1. What is the frequency of the flip-flop output signal?

(A) 2 MHz (B) 500 kHz (C) 250 kHz (D) 500 MHz

---

4. How many inputs and output does a full adder have?

(A) 3, 2 (B) 2, 3 (C) 3, 3 (D) 2, 2

---

5. Which shift register counter requires the most decoding circuitry?

(A) Johnson counter (B) Ring counter

(C) Ripple counter (D) MOD counter

---

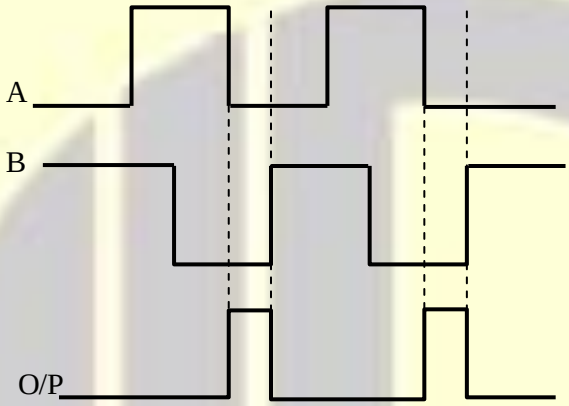
6. A 10-bit DAC has a step size of 10 mV. What is its full scale output voltage and the percentage resolution?

(A) 10.24 V, 0.2% (B) 10.23 V, 0.5%

(C) 10.23 V, 0.1% (D) 10.24 V, 0.1%

---

7. If the input signals (A and B) and output signals are as shown in the figure, then the circuit element is



(A) AND Gate (B) OR Gate (C) NOR Gate (D) XOR Gate

---

8. For a 10-bit digital ramp ADC using 500 kHz clock, the maximum conversion time is

(A) 2048 μs (B) 2064 μs (C) 2046 μs (D) 2084 μs

---

9. In digital filters, how many interpolated data points are inserted between samples when performing 4 × over sampling?

(A) 2 (B) 3 (C) 4 (D) 5

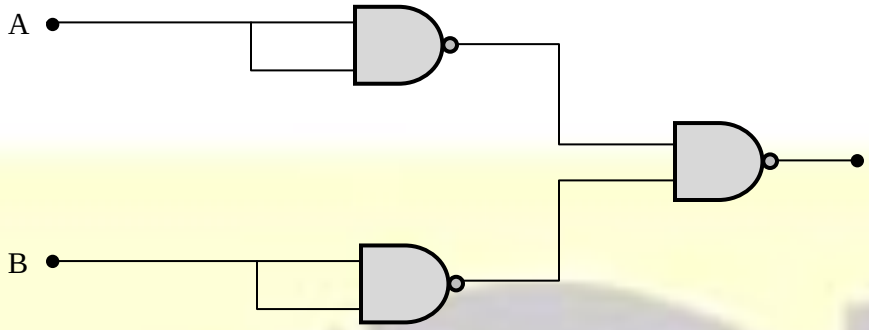
---

10. A PAM source generates four symbols 3V, 1V, –1V and –3V with probability of $p(3)=0.2, p(1)=0.3, p(-1)=0.3, p(-3)=0.2,$ respectively. The variance for this source will be

(A) 4.2 V (B) 3.2 V (C) 3.6 V (D) 4.6 V

---

11. The output equivalent circuit of following circuit is



(A) inverter (B) AND (C) OR (D) NOR

---

12. A binary source in which 0's occurs 3 times as often as 1's. Then, its entropy in bits/symbol will be

(A) 0.75 bits/symbol (B) 0.25 bits/symbol

(C) 0.81 bits/symbol (D) 0.85 bits/symbol

---

13. Maximum value of signal to noise ratio of an 8-bit ADC with an input range of 10V will be

(A) 50 dB (B) 43.8 dB (C) 48.9 dB (D) 49.8 dB

---

14. The available power required at a receiving antenna is 10^{-6} W. Transmitting and receiving antennas have gain of 40 dB each. The carrier frequency is 4 GHz and the distance between them is 30 miles. The required transmitter power is

(A) 0.64 W (B) 0.74 W (C) 0.78 W (D) 0.32 W

---

15. An FM signal at 10.7 MHz IF needs to be digitized for demodulation in a digital domain. If the bandwidth of this signal is 200 kHz, the maximum usable sampling frequency is

(A) 200 kHz (B) 600 kHz (C) 400 kHz (D) 800 kHz

---

16. A satellite system employs QPSK modulation with 40% excess bandwidth per carrier including guard band. The voice channels use 64 kbps PCM coding. The number of channels supported by 36 MHz bandwidth of the transponder in bandwidth limited case will be

(A) 1000 (B) 800 (C) 900 (D) 600

17. Hamming codes are used for

(A) burst error correction
(B) signal error correction
(C) both (A) and (B)
(D) none of these

18. Which statement is correct for Schottky diode?

(A) Current voltage characteristics is totally different than that of a p-n junction diode
(B) The current is controlled by the diffusion of minority carriers
(C) The current results from the flow of minority carriers
(D) The storage time t_s is almost zero

19. Photodiodes operate at

(A) forward bias
(B) breakdown region
(C) reverse bias
(D) saturation region

20. The dynamic resistance of diode varies as

(A) $\frac{1}{I^2}$ (B) $\frac{1}{I}$ (C) I (D) I^2

21. In a p-n diode, with the increase reverse bias, the reverse current

(A) increases
(B) decreases
(C) remains constant
(D) uncertain

22. The Nyquist filter has impulse response given by

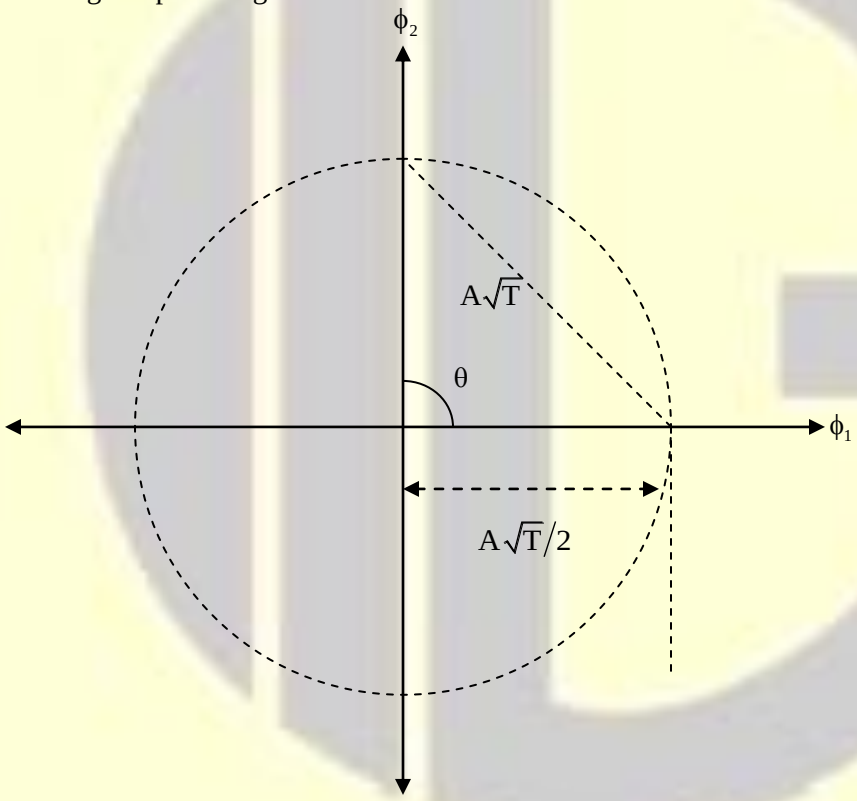
(A) $h(t)=\dfrac{\left[\sin\left(\dfrac{\pi t}{T}\right)\right]}{\left(\dfrac{\pi t}{T}\right)}$

(B) $h(t)=\dfrac{1}{2}\left[\dfrac{\sin(\pi t)}{(\pi t)}\right]$

(C) $h(t)=\dfrac{\sin(\pi t)}{\left(\dfrac{\pi t}{T}\right)}$

(D) $h(t)=\dfrac{\cos(\pi t)}{\left(\dfrac{\pi t}{T}\right)}$

23. Shown signal space diagram is for



(A) quadrature QPSK

(B) binary FSK

(C) bi-Phase PSK

(D) MSK

24. Negative feedback in amplifiers

(A) improves the signal-to-noise ratio at the input

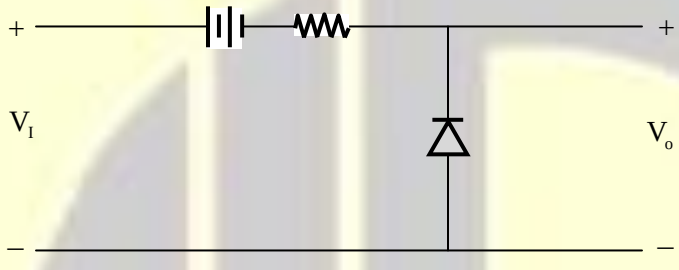
(B) improves the signal-to-noise ratio at the output

(C) doesn't affect the signal-to-noise ratio at the output

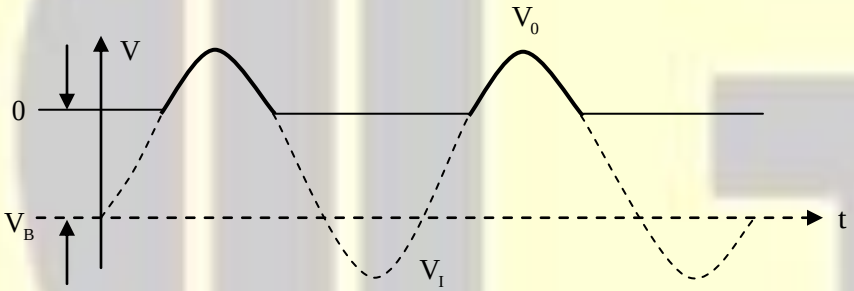
(D) all of these

---

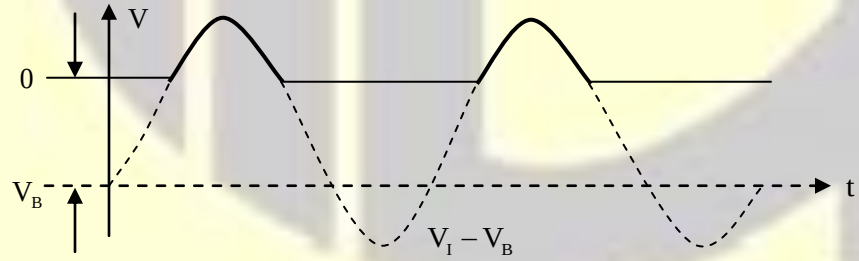
25. Output response of a diode clipper circuit shown in figure will be



(A)



(B)



(C) Both (A) and (B)

(D) None of these

---

26. For an n-channel MOSFET, if condention parameter (k_a) is 0.249 mA V^{-2}, gate to source voltage V_{GS} is $2V_{IN}$ where $V_{IN} = 0.75V$. The current will be

(A) 0.160 mA (B) 0.150 mA (C) 0.140 mA (D) 0.170 mA

---

27. If $\alpha = 0.98$, $I_{CO} = 6\,\mu A$, and $I_R = 100\,\mu A$ for a transistor, then the value of I_C will be

(A) 2.3 mA (B) 3.1 mA (C) 4.6 mA (D) 5.2 mA

---

28. A unit step voltage $2u(t-\theta)$ is applied in a series RC circuit with $R = 2\Omega$, C = 1F. Assuming zero initial conditions, find I(t)

(A) $I(t) = u(t)e^{-0.5(t)}A$ (B) $I(t) = u(t-2\theta)e^{-0.5(t-2\theta)}A$

(C) $I(t) = u(t-\theta)e^{-0.5(t-\theta)}A$ (D) $I(t) = u(t-\theta)e^{-(t-\theta)}A$

---

29. The autocorrelation of a wide-sense stationary random process is given by $e^{-2|\tau|}$. The peak value of the spectral density is

(A) 2 (B) 1 (C) $e^{-1/2}$ (D) e

---

30. Which of the following gives piezoelectric effect?

(A) μ metal (B) PVDF (C) Saphire (D) Ferrite

---

31. The mean free path for electron drift increases with

(A) purity (B) strain hardening

(C) elastic modules (D) none of these

---

32. Pure metals generally have

(A) high conductivity and low temperature coefficient

(B) high conductivity and high temperature coefficient

(C) low conductivity and zero temperature coefficient

(D) low conductivity and high temperature coefficient

---

33. A typical optical fiber has

(A) high refractive index core and low refractive index cladding

(B) low refractive index core and high refractive index cladding

(C) uniform refractive index core surrounded by variable refractive index cladding

(D) none of these

---

34. The ceramic materials are

(A) inorganic substances

(B) brittle

(C) good thermal insulators

(D) all of these

---

35. The best definition of a superconductor is

(A) it is material showing perfect conductivity and Meissner effect below a critical temperature

(B) It is conductor having zero resistance

(C) It is a perfect conductor with highest diamagnetic susceptibility

(D) It is a perfect conductor but becomes resistive when the current density through it exceeds a critical value

---

36. A periodic function of half wave symmetry is necessarily

(A) an even function

(B) an odd function

(C) neither odd nor even

(D) both odd and even

---

37. The Fourier transform of a Gaussian time pulse is

(A) uniform

(B) a pair of impulses

(C) Gaussian

(D) Rayleigh

---

38. The covariance function $C_x(\tau)$ of a stationary stochastic process x(t) is said to be positive definite. This means that

(A) $C_x(\tau) \geq 0$ for all τ

(B) $\int_{-\infty}^{\infty} C_x(\tau)d\tau \geq 0$

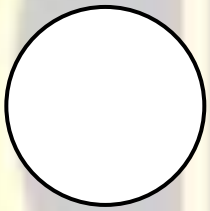
(C) $\int_{-\infty}^{\infty} C_x(\tau)\exp(-j\omega\tau)d\tau \geq 0$

(D) $C_x(0) \geq 0$

---

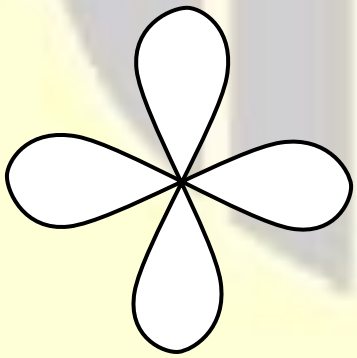
39. If a vertical dipole antenna is used in conjunction with a loop antenna for direction finding, the field pattern obtained will be

(A)

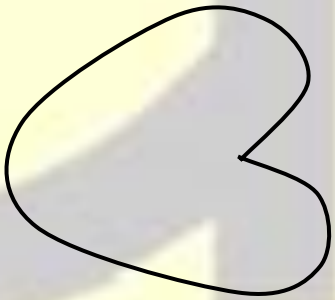


(B)

(C)



(D)



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40. The coding system typically used in digital telemetry is

(A) PPM (pulse position modulation)

(B) PAM (pulse amplitude modulation)

(C) PCM (pulse code modulation)

(D) PDM (pulse duration modulation)

---

41. The temperature coefficient of resistance for a thermistor is

(A) low and negative
(B) low and positive
(C) high and negative
(D) high and positive

42. Compared to field effect phototransistor, bipolar phototransistors are

(A) more sensitive and faster
(B) less sensitive and slower
(C) more sensitive and slower
(D) less sensitive and faster

43. A uniform plane wave in air impinge at 45° angle on a lossless dielectric material with dielectric constant ε_r. The transmitted wave propagates in a 30° direction with respect to the normal. The value of ε_r is

(A) 1.5 (B) $\sqrt{1.5}$ (C) 2 (D) $\sqrt{2}$

44. If a donor type impurity is added to the semiconductor, then at a given temperature, the Fermi level

(A) moves towards the centre of the energy gap
(B) moves towards the valence band
(C) moves towards the conduction band
(D) does not change

45. Which of the following statement is correct?

(A) In semiconductors, electron and holes move in an electric field and in the same direction
(B) Electric field density is exactly equal to the sum of electric field intensity and polarization
(C) Ampere's circuital law states that the line integral of $\vec{H}$ about any closed path is exactly equal to the direct current enclosed by that path
(D) None of these

46. Magnetic field intensity (H), within a magnetic material where, M = 150 Am^{-1}, $\mu = 1.5\times10^{-5}\,H\,m^{-1}$, $\mu_r = 30$;

(A) $14.921\,A\,m^{-1}$ (B) $14.138\,A\,m^{-1}$

(C) $1.82\,A\,m^{-1}$ (D) $13.715\,A\,m^{-1}$

---

47. A steel pipe is constructed of a material for which $\mu_r = 200$ and $\sigma = 5\times10^{6}\,\Omega^{-1}m^{-1}$. The outer and inner radii are 8 and 6 mm, respectively, and the length is 80 m. If the total current carried by the pipe is $2\cos\left(10^4\pi t\right)A$, then the skin depth will be

(A) $0.225\times10^{-3}\,m$ (B) $0.300\times10^{-3}\,m$

(C) $0.352\times10^{-3}\,m$ (D) $0.125\times10^{-3}\,m$

---

48. A small amount of phosphorus is added to silicon so that there are 2.5×10^{17} conduction electrons per cubic meter and 9.0×10^{14} holes per cubic meter. Let $\mu_e = 0.13\,m^2V^{-1}s^{-1}$ and $\mu_h = 0.05\,m^2V^{-1}s^{-1}$. The resistivity in $\Omega\,m$ will be

(A) 5.2072 (B) 192.042 (C) 129.02 (D) 0

---

49. Silicon dioxide is used in ICs

(A) because it facilitates the penetration of diffurants

(B) because of its high heat conduction

(C) to control the location of diffusion and to protect and insulate the Si surface

(D) to control the concentration of diffurants

---

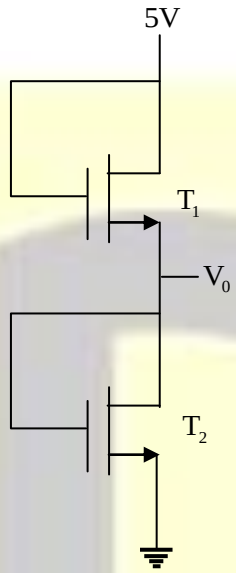
50. Evaluate: $\int_0^1\int_0^{\sqrt{1+x^2}} \frac{dxdy}{\left(1+x^2+y^2\right)}$

(A) $\frac{\pi}{2}\left[\log\left(1+\sqrt{2}\right)\right]$ (B) $\frac{\pi}{4}\left[\log\left(1+\sqrt{2}\right)\right]$

(C) $\frac{\pi}{2}\left[\log\left(1-\sqrt{2}\right)\right]$ (D) $\frac{\pi}{4}\left[\log\left(1-\sqrt{2}\right)\right]$

---

51. Both transistors T_1 and T_2 in figure have a threshold voltage of 1V. The device parameters K_1 and K_2 of T_1 and T_2 are $36\,\mu A\,V^{-2}$ and $9\,\mu AV^{-2}$, respectively. The output voltage V_0 is



(A) 1V (B) 2V (C) 3V (D) 4V

---

52. A ramp input applied to a unity feedback system results in 5% steady-state error. The type number and zero frequency gain of the system are

(A) 1 and 20 (B) 0 and 20 (C) 0 and 1/20 (D) 1 and 1/20

---

53. The magnitude of frequency response of an under-sampled second-order system is 5 at 0 rad s^{-1} and peaks to $10/\sqrt{3}$ at $5/\sqrt{2}$ rad s^{-1}. The transfer function of the system is

(A) $\dfrac{500}{\left(s^2+10s+100\right)}$ (B) $\dfrac{375}{\left(s^2+5s+75\right)}$

(C) $\dfrac{720}{\left(s^2+12s+144\right)}$ (D) $\dfrac{1125}{\left(s^2+25s+225\right)}$

---

54. The system with the open loop transfer function $G(s)H(s)=\dfrac{1}{s(s^2+s+1)}$ has a gain margin of

(A) –6 dB (B) zero (C) 3.5 dB (D) 6 dB

55. Given: $f(t)=L^{-1}\left[\dfrac{3s+1}{s^3+4s^2+(k-3)}\right]$, if $\lim\limits_{x\to\pi} f(t)=1$, then the value of k is

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

56. A person on a trip has a choice between private car and public transport. The probability of using a private car is 0.45. While using public transport, further choice available are bus and metro. Out of which the probability of commuting by a bus is 0.55. In such a situation, the probability (rounded upto two decimals) of using a car, bus and metro respectively would be

(A) 0.45, 0.30 and 0.25 (B) 0.45, 0.25 and 0.30

(C) 0.45, 0.55 and 0 (D) 0.45, 0.35 and 0.20

57. A real root of equation $x^3-5x-7=0$ by the method of false position correct to three decimal places is

(A) 2.7472 (B) 2.084 (C) 2.077 (D) None of these

58. Find the z-transform of cosh (nθ)

(A) $\dfrac{z(z-\cosh\theta)}{(z^2-2z\cosh\theta+1)}$ (B) $\dfrac{z(z-\cosh\theta)}{(z^2-2z\cosh\theta)}$

(C) $\dfrac{(z-\cosh\theta)}{(z^2-2z\cosh\theta+1)}$ (D) $\dfrac{z(z-\coth\theta)}{(z^2-2z\coth\theta+1)}$

59. Newton-Raphson iteration formula for finding $\sqrt[3]{C}$, where C > 0 is

(A) $x_{n+1} = \dfrac{2x_n^3 + \sqrt[3]{C}}{3x_n^2}$

(B) $x_{n+1} = \dfrac{2x_n^3 - \sqrt[3]{C}}{3x_n^2}$

(C) $x_{n+1} = \dfrac{2x_n^2 + C}{3x_n^2}$

(D) $x_{n+1} = \dfrac{2x_n^2 - C}{3x_n^2}$

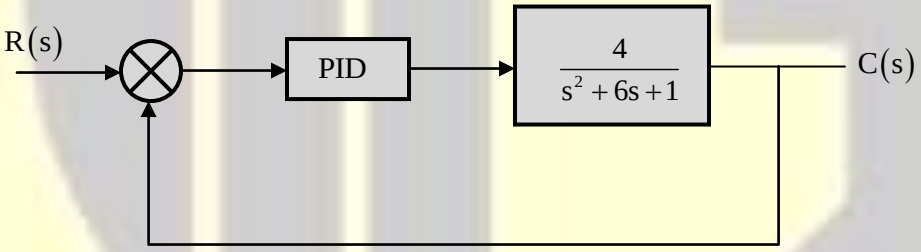
---

60. The value of $\lim\limits_{x\to 8}\left(\dfrac{x^{1/3}-2}{x-8}\right)$ is

(A) $\dfrac{1}{16}$ (B) $\dfrac{1}{12}$ (C) $\dfrac{1}{8}$ (D) $\dfrac{1}{4}$

---

61. Find the value of K_p, K_1 and K_D for PID controller whose characteristics equation has real roots at 10, $\xi = 0.8$ and $\omega_n = 2 \text{ rad s}^{-1}$



(A) $K_D = 1.8, K_P = 8, K_1 = 10$

(B) $K_D = 1.8, K_P = 4, K_1 = 5$

(C) $K_D = 3.6, K_P = 8, K_1 = 20$

(D) $K_D = 1.8, K_P = 8, K_1 = 20$

---

62. The transfer function $\left(\dfrac{1+0.5s}{1+s}\right)$ represents a

(A) lag network

(B) lead network

(C) lag-lead network

(D) proportional controller

---

63. The wavelength of emitted radiation by electron while transiting from one energy state of –15 eV to other energy state of –5 eV is

(A) $1000\ \overset{o}{A}$ (B) $1240\ \overset{o}{A}$ (C) $1280\ \overset{o}{A}$ (D) $1300\ \overset{o}{A}$

64. According to maximum power transfer theorem, maximum power transfer occurs when

(A) load R is equal to the half the R of network

(B) load R is equal to twice the R of network

(C) load R is equal to the R of network looking back at it from voltage terminal

(D) load R is equal to the R of network looking back at it from load terminals with all sources being replaced by their respective internal resistance

65. How does the dynamic resistance of diode vary with temperature?

(A) Directly proportional

(B) Inversely proportional

(C) Independent

(D) Directly to the square of temperature

66. The electric field component of a time harmonic plane EM wave traveling in a non-magnetic lossless dielectric medium has amplitude of $2V\,m^{-1}$. If the relative permittivity of the medium is 4, the magnitude of the time-average power density vector (in $W\ m^{-2}$) is

(A) $\frac{1}{30\pi}$ (B) $\frac{1}{120\pi}$ (C) $\frac{1}{60\pi}$ (D) $\frac{1}{240\pi}$

67. The force on a point charge + q kept at a distance d from the surface of an infinite grounded metal plate in a medium of permittivity ε is

(A) 0

(B) $\frac{q^2}{16\pi\varepsilon d^2}$, away from the plate

(C) $\frac{q^2}{16\pi\varepsilon d^2}$, towards the plate

(D) $\frac{q^2}{4\pi\varepsilon d^2}$, towards the plate

68. A material has conductivity of $10^{-2}\Omega^{-1}m^{-1}$ and relative permittivity of 4. The frequency at which the conduction current in the medium is equal to the displacement current is

(A) 45 MHz (B) 90 MHz (C) 450 MHz (D) 900 MHz

69. A system has fourteen poles and two zeros. Its high frequency asymptote in its magnitude plot having a slope of

(A) –40 dB/decade (B) –240 dB/decade

(C) –280 dB/decade (D) –320 dB/decade

70. A 1mW video signal having a bandwidth of 100 MHz is transmitted to a receiver through a cable that has 40 dB loss. If the effective one-sided noise spectral density at the receiver is 10^{-20} W/Hz, then the signal-to-noise ratio at the receiver is

(A) 50 dB (B) 30 dB (C) 40 dB (D) 60 dB

71. When the 8051is reset and the line is HIGH, the program counter points to the first program instruction in the

(A) internal code memory (B) external code memory

(C) internal data memory (D) external data memory

72. How is the status of the carry, auxiliary carry and parity flag affected if write the following instruction?

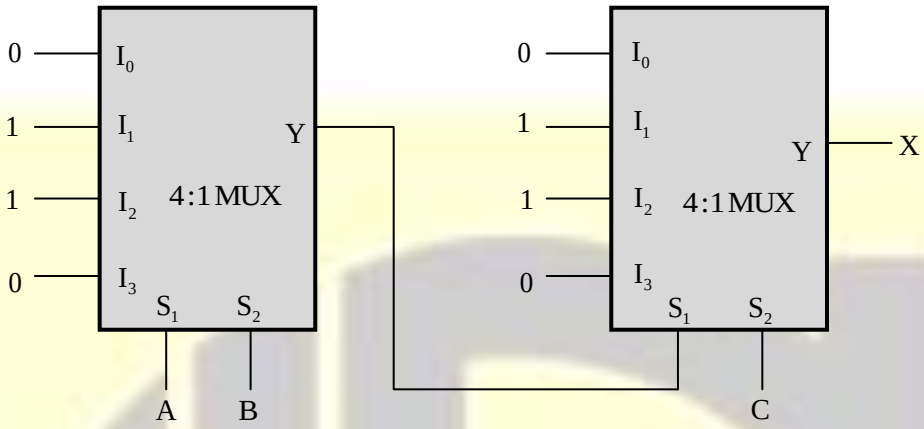
MOV A, #9C

ADD A, #64H

(A) CY = 0, AC = 0, P = 0 (B) CY = 1, AC = 1, P = 0

(C) CY = 0, AC = 1, P = 0 (D) CY = 1, AC = 1, P = 1

73. In the given combinational logic, X is given by



(A) $X = A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}\bar{B}C + ABC$

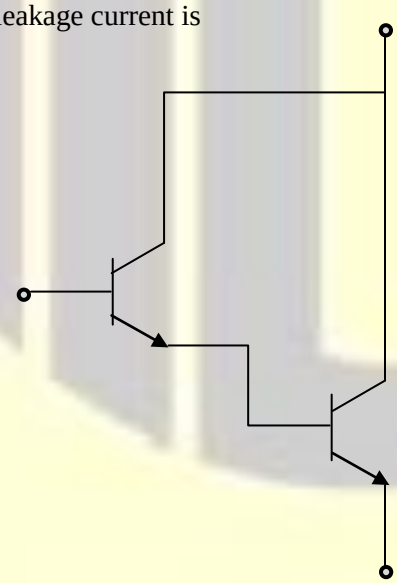
(B) $X = \bar{A}BC + A\bar{B}C + AB\bar{C} + \bar{A}\bar{B}\bar{C}$

(C) $X = AB + BC + AC$

(D) $X = \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{C}$

---

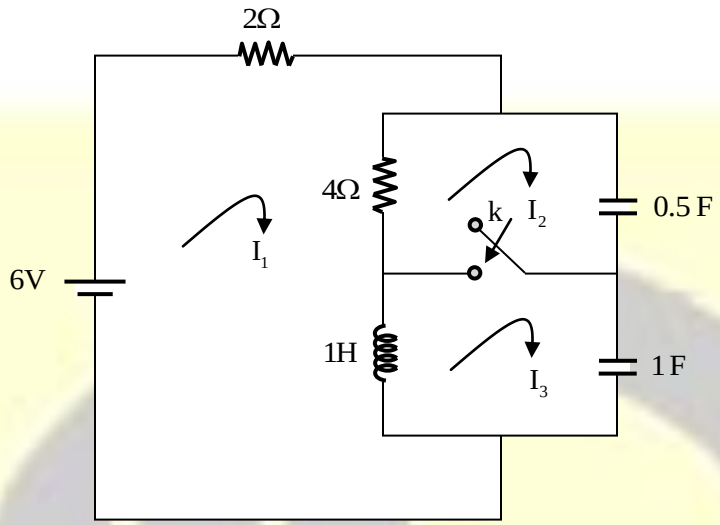
74. Each transistor in Darlington pair (as shown in the figure) has $h_{fc} = 100$. Overall h_{FE} of composite transistor neglecting leakage current is



(A) 10000 (B) 10001 (C) 10100 (D) 10200

---

75. In a given network (shown in the figure), a steady state is reached with switch k open. At t = 0, which is closed. Determine the values of I_1, I_2 and I_3 at $t = 0+$.



(A) 1A, 1/3A, 0A

(B) 1/3A, 1/3A, 1/3A

(C) 0A, 0A, 0A

(D) 1A, 1A, 0A

---

76. Simplify Boolean function represented in sum of product of minterms, $F(x,y,z) = \Sigma(0,2,4,5,6)$

(A) $\bar{z} + x\bar{y}$

(B) $\bar{x}\,\bar{y}\,\bar{z} + xyz + x\bar{y}\,\bar{z}$

(C) $xyz + \bar{x} + \bar{y} + \bar{z}$

(D) $xy + yz + zx$

---

77. A system described by the transfer function $H(s) = \dfrac{1}{s^3 + \alpha s^2 + ks + 3}$ is stable. The constraints on α and k are

(A) $\alpha > 0, \alpha k < 3$

(B) $\alpha > 0, \alpha k > 3$

(C) $\alpha > 0, \alpha k > 0$

(D) $\alpha > 0, \alpha k < 0$

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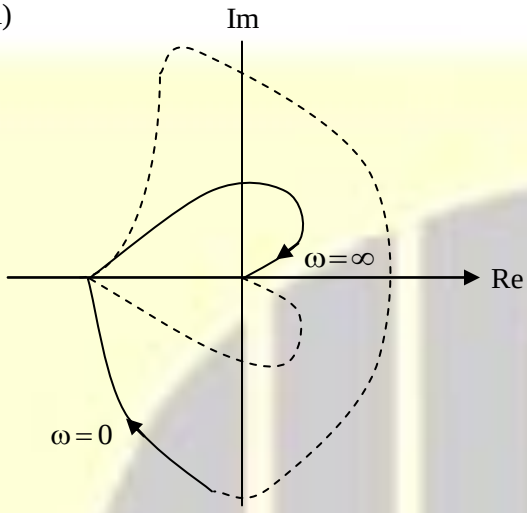
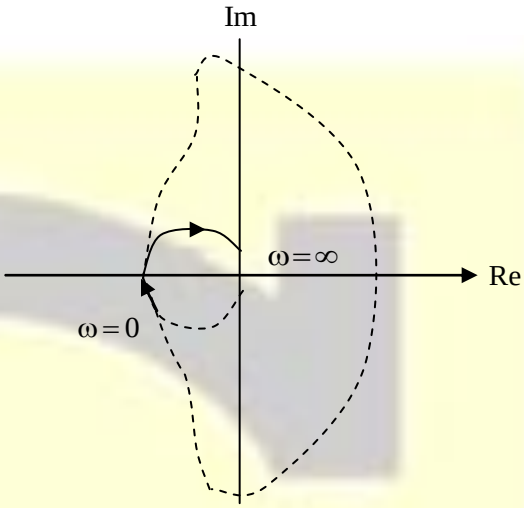
78. Consider a unity feedback system whose open loop transfer function is $G(s)=\dfrac{k}{s\left(s^2+2s+2\right)}$. The Nyquist plot for this system is

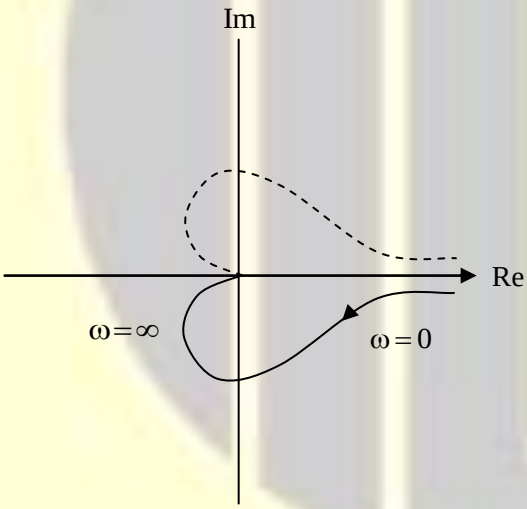
(A)



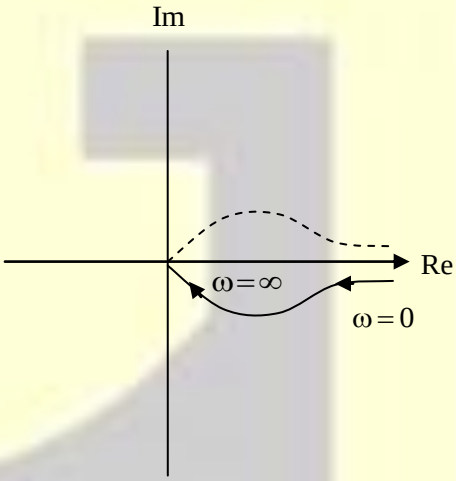
(B)



(C)



(D)



79. Eye diagram gives an idea of

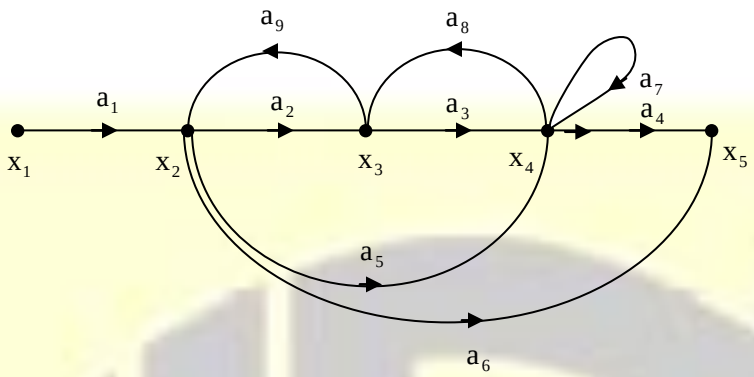
(A) modulation scheme

(B) clock jitter

(C) SNR

(D) all of these

80. The signal flow diagram for a certain feedback control system is shown in the figure.



Now, consider the following set of equations for the nodes:

1. $x_2 = a_1x_1 + a_9x_3$

2. $x_3 = a_2x_2 + a_5x_4$

3. $x_4 = a_3x_3 + a_5x_2$

4. $x_5 = a_4x_4 + a_6x_2$

Which of the following are correct?

(A) 1, 2 and 3 (B) 1, 3 and 4 (C) 2, 3 and 4 (D) 1, 2 and 4