GENERAL APTITUDE

Q. No. 1 - 5 Carry One Mark Each

1. She has a sharp tongue and it can occasionally turn _____.

(A) hurtful (B) left (C) methodical (D) vital

Answer: (A)

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2. Some table are shelves. Some shelves are chairs. All chairs are benches. Which of the following conclusion can be deduced from the preceding sentences?

(i) At least one bench is a table

(ii) At least one shelf is a bench

(iii) At least one chair is a table

(iv) All benches are chairs

(A) only (i) (B) only (ii) (C) only (ii) and (iii) (D) only (iv)

Answer: (B)

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3. 40% of deaths on city roads may be attributed to drunken driving. The number of degree needed to represent this as a slice of a pie chart is

(A) 120 (B) 144 (C) 160 (D) 212

Answer: (B)

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4. In the summer, water consumption is known to decrease overall by 25%. A water Board official states that in the summer household consumption decreases by 20%, while other consumption increases by 70%.

Which of the following statement is correct?

(A) The ratio of household to other consumption is 8/17

(B) The ratio of household to other consumption is 1/17

(C) The ratio of household to other consumption is 17/8

(D) There are errors in the official's statement

Answer: (D)

5. I _____ made arrangements had I _____informed earlier.

(A) could have, been (B) would have, being

(C) had, have (D) had been, been

Answer: (A)

Q. No. 6- 10 Carry Two Marks Each

6. "If you are looking for a history of India, or for an account of the rise and fall of the British Raj, or for the reason of the cleaving of the subcontinent into two mutually antagonistic parts and the effects this mutilation will have in the respective section, and ultimately on Asia, you will not find it in these pages; for though I have spent a lifetime in the country. I lived too near the seat of events, and was too intimately associated with the actors, to get the perspective needed for the impartial recording of these matters".

Here, the word 'antagonistic' is closest in meaning to

(A) impartial (B) argumentative (C) separated (D) hostile

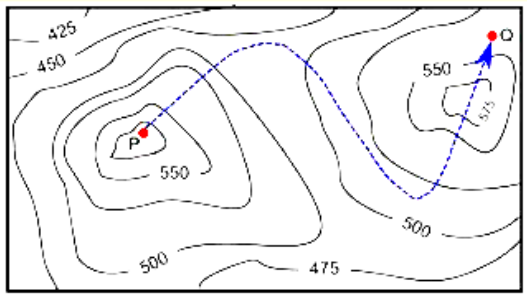
Answer: (D)

7. There are 3 Indians and 3 Chinese in a group of 6 people. How many subgroups of this group can we choose so that every subgroup has at least one Indian?

(A) 56 (B) 52 (C) 48 (D) 44

Answer: (A)

8. A contour line joints locations having the same height above the mean sea level. The following is a contour plot of a geographical region. Contour lines are shown at 25 m intervals in this plot.



The path from P to Q is best described by

(A) Up-Down-Up-Down

(B) Down-Up-Down-Up

(C) Down-Up-Down

(D) Up-Down-Up

Answer: (C)

9. Trucks (10m long) and cars (5 m long) go on a single lane bridge. There must be a gap of atleast 20 m after each truck and a gap of atleast 15m after each car. Trucks and cars travel at a speed of 36 km/h. If cars and trucks go alternatively, what is the maximum number of vehicles that can use the bridge in one hour?

(A) 1440 (B) 1200 (C) 720 (D) 600

Answer: (A)

10. S, T, U, V, W, X, Y and Z are seated around a circular table. T's neighbours are Y and V. Z is seated third to the left of T and second to the right of S.U'sneighbours are S and Y; and T and W are not seated opposite each other. Who is third to the left of V?

(A) X (B) W (C) U (D) T

Answer: (A)

ELECTRONICS AND COMMUNICATION ENGINEERING

Q. No. 1 to 25 Carry One Mark Each

1. The clock frequency of an 8085 microprocessor is 5 MHz. If the time required to execute an instruction is 1.4 μs, then the number of T-states needed for executing the instruction is

(A) 1 (B) 6 (C) 7 (D) 8

Answer: (C)

---

2. Consider a single input single output discrete-time system with x[n] as input and y[n] as output, where the two are related as

$$y[n]=\begin{cases} n|x[n]| & \text{for } 0\le n\le 10 \\ x[n]-x[n-1] & \text{otherwise} \end{cases}$$

Which one of the following statements is true about the system?

(A) It is causal and stable
(B) It is causal but not stable
(C) It is not causal but stable
(D) It is neither causal nor stable

Answer: (A)

---

3. Consider the following statement about the linear dependence of the real valued functions $y_1=1, y_2=x$ and $y_3=x^2$, over the field of real numbers.

I. y_1, y_2 and y_3 are linearly independent on $-1\le x\le 0$

II. y_1, y_2 and y_3 are linearly dependent on $0\le x\le 1$

III. y_1, y_2 and y_3 are linearly independent on $0\le x\le 1$

IV. y_1, y_2 and y_3 are linearly dependent on $-1\le x\le 0$

Which one among the following is correct?

(A) Both I and II are true
(B) Both I and III are true
(C) Both II and IV are true
(D) Both III and IV are true

Answer: (B) Click here to watch video explanation

4. Consider the 5 × 5 matrix

$$A=\begin{bmatrix}1 & 2 & 3 & 4 & 5\\ 5 & 1 & 2 & 3 & 4\\ 4 & 5 & 1 & 2 & 3\\ 3 & 4 & 5 & 1 & 2\\ 2 & 3 & 4 & 5 & 1\end{bmatrix}$$

It is given that A has only one real eigen value. Then the real eigen value of A is

(A) –2.5 (B) 0 (C) 15 (D) 25

Answer: (C) Click here to watch video explanation

5. The voltage of an electromagnetic wave propagating in a coaxial cable with uniform characteristic impedance is $V(\ell)=e^{-\gamma\ell+j\omega t}$ volts, where ℓ is the distance along the length of the cable in meters. $\gamma=(0.1+j40)m^{-1}$ is the complex propagation constant, and $\omega=2\pi\times10^9$ rad/s is the angular frequency.Theabsolute value of the attenuation in the cable in dB/meter is _____.

Answer: (0.868) Click here to watch video explanation

6. A bar of Gallium Arsenide (GaAs) is doped with Silicon such that the Silicon atoms occupy Gallium and Arsenic sites in the GaAs crystal. Which one of the following statement is true?

(A) Silicon atoms act as p-type dopants in Arsenic sites and n-type dopants in Gallium sites

(B) Silicon atoms act as n-type dopants in Arsenic sites and p-type dopants in Gallium sites

(C) Silicon atoms act as p-type dopants in Arsenic as well as Gallium sites

(D) Silicon atoms act as n-type dopants in Arsenic as well as Gallium sites

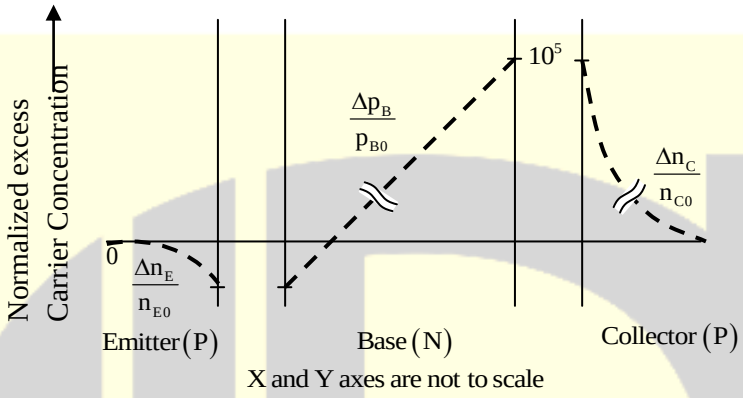
Answer: (A)

7. The rank of the matrix $M=\begin{bmatrix}5 & 10 & 10\\ 1 & 0 & 2\\ 3 & 6 & 6\end{bmatrix}$ is

(A) 0 (B) 1 (C) 2 (D) 3

Answer: (C) Click here to watch video explanation

8. For a narrow base PNP BJT, the excess minority carrier concentration $(\Delta n_E$ for emitter, Δp_B for base. Δn_C for collector$)$ normalized to equilibrium minority carrier concentration $(n_{E0}$ for emitter, p_{B0} for base, n_{C0} for collector$)$ in the quasi-neutral emitter, base and collector regions are shown below. Which one of the following biasing modes is the transistor operating in?



(A) Forward active (B) Saturation (C) Inverse active (D) Cutoff

Answer: (C) Click here to watch video explanation

9. The Miller effect in the context of a Common Emitter amplifier explains

(A) an increase in the low-frequency cutoff frequency

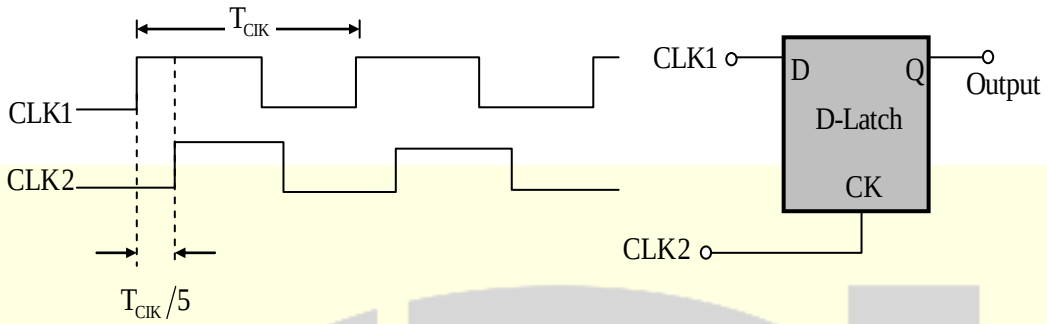
(B) an increase in the high-frequency cutoff frequency

(C) a decrease in the low-frequency cutoff frequency

(D) a decrease in the high-frequency cutoff frequency

Answer: (D) Click here to watch video explanation

10. Consider the D-Latch shown in the figure, which is transparent when its clock input CK is high and has zero propagation delay.



In the figure, the clock signal CLK1 has a 50% duty cycle and CLK2 is a one-fifth period delayed version of CLK1.

The duty cycle at the output latch in percentage is _____.

Answer: (30)

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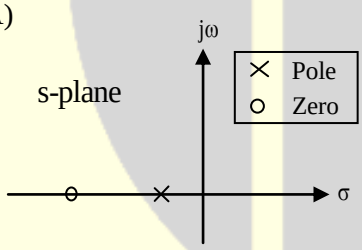
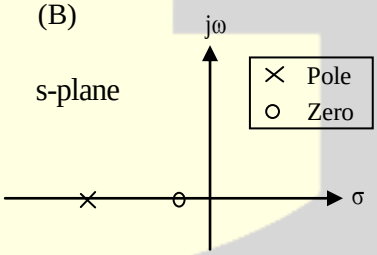
11. Which of the following can be pole-zero configuration of a phase-lag controller (lag compensator)?

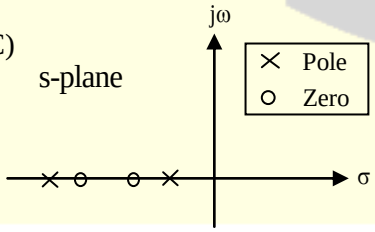
(A)



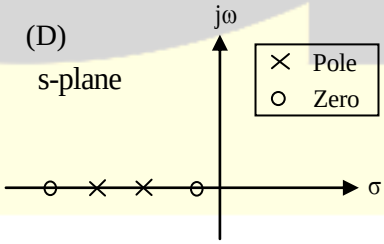
(B)



(C)

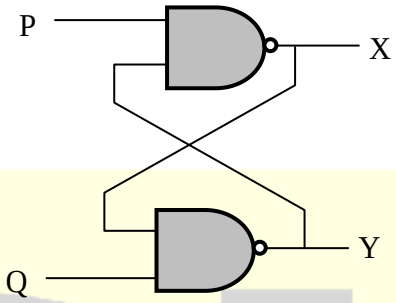


(D)



Answer: (A)

12. In the latch circuit shown, the NAND gates have non-zero, but unequal propagation delays. The present input condition is: P = Q = '0'. If the input condition is changed simultaneously to P = Q = '1', the outputs X and Y are



(A) X = '1', Y = '1'

(B) either X = '1', Y = '0' or X = '0', Y = '1'

(C) either X = '1', Y = '1' or X = '0', Y = '0'

(D) X = '0', Y = '0'

Answer: (B)

13. Three fair cubical dice are thrown simultaneously. The probability that all three dice have the same number of dots on the faces showing up is (up to third decimal place) ____.

Answer: (0.028) Click here to watch video explanation

14. A periodic signal x(t) has a trigonometric Fourier series expansion

$$x(t) = a_0 + \sum_{n=1}^{\infty}(a_n \cos n\omega_0 t + b_n \sin n\omega_0 t).$$

If $x(t) = -x-(t) = -x(t - \pi/\omega_0)$, we can conclude that

(A) a_n are zero for all n and b_n are zero for n even

(B) a_n are zero for all n and b_n are zero for n odd

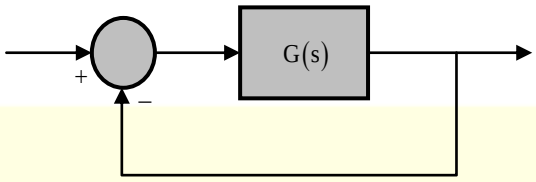
(C) a_n are zero for n even and b_n are zero for n odd

(D) a_n are zero for n odd and b_n are zero for n even

Answer: (A)

15. The open loop transfer function $G(s)=\dfrac{(s+1)}{s^p(s+2)(s+3)}$

Where p is an integer, is connected in unity feedback configuration as shown in figure.



Given that the steady state error is zero for unit step input and is 6 for unit ramp input, the value of the parameter p is _____.

Answer: (1)

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16. An n^+-n Silicon device is fabricated with uniform and non-degenerate donor doping concentrations of $N_{D1}=1\times10^{18}\,cm^{-3}$ and $N_{D2}=1\times10^{15}\,cm^{-3}$ corresponding to the n^+ and n regions respectively. At the operational temperature T, assume complete impurity ionization, kT/q = 25 mV, and intrinsic carrier concentration to be $n_i=1\times10^{10}\,cm^{-3}$. What is the magnitude of the built-in potential of this device?

(A) 0.748V (B) 0.460V (C) 0.288V (D) 0.173V

Answer: (D) Click here to watch video explanation

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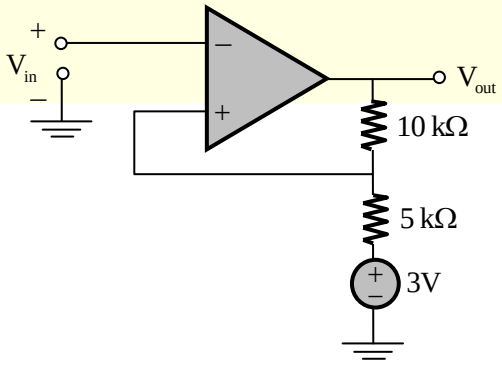
17. For the operational amplifier circuit shown, the output saturation voltages are ±15V. The upper and lower threshold voltages for the circuit are, respectively.

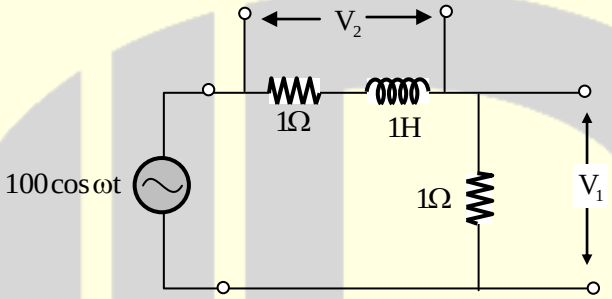


(A) +5V and −5V (B) +7V and −3V

(C) +3V and −7V (D) +3V and−3V

Answer: (B) Click here to watch video explanation

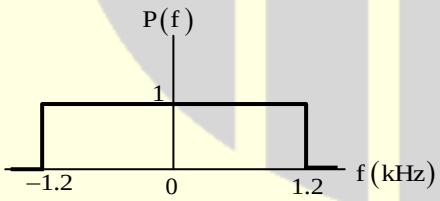
18. In the circuit shown, the positive angular frequency ω (in radians per second) at which magnitude of the phase difference between the voltages V_1 and V_2 equals $\frac{\pi}{4}$ radians, is _____.



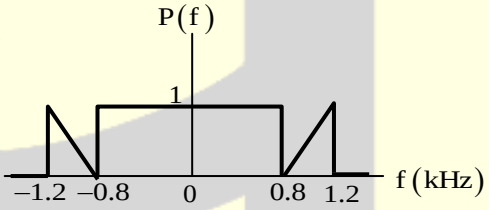
Answer: (1) Click here to watch video explanation

19. In a digital communication system, the overall pulse shape p(t) at the receiver before the sampler has the Fourier transform P(f). If the symbols are transmitted at the rate of 2000 symbols per second, for which of the following cases is inter symbol interference zero?

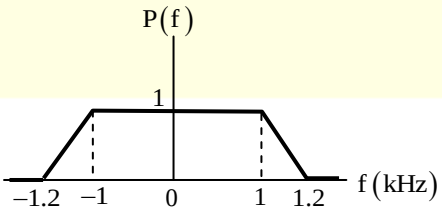
(A)



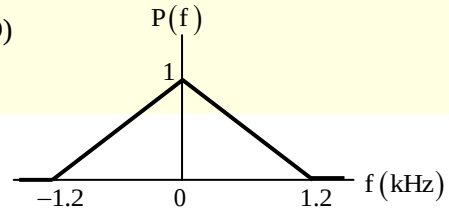
(B)



(C)



(D)



Answer: (B) Click here to watch video explanation

20. Consider a stable system with transfer function

$$G(s)=\frac{s^p+b_1s^{p-1}+\cdots+b_p}{s^q+a_1s^{q-1}+\cdots+a_q}$$

Where $b_1,\cdots,b_p$ and $a_1,\cdots a_q$ are real valued constants. The slope of the Bode log magnitude curve of G(s) converges to $-60\,\text{dB/decade}$ as $\omega\to\infty$. A possible pair of values for p and q is

(A) $p=0$ and $q=3$ (B) $p=1$ and $q=7$

(C) $p=2$ and $q=3$ (D) $p=3$ and $q=5$

Answer: (A)

21. A good transconductance amplifier should have

(A) high input resistance and low output resistance

(B) low input resistance and high output resistance

(C) high input and output resistances

(D) low input and output resistance

Answer: (C) Click here to watch video explanation

22. Let (X_1,X_2) be independent random variables. X_1 has mean 0 and variance 1, while X_2 has mean 1 and variance 4. The mutual information $I(X_1;X_2)$ between X_1 and X_2 in bits is _____.

Answer: (0) Click here to watch video explanation

23. Consider the following statements for continuous-time linear time invariant (LTI) systems.

I. There is no bounded input bounded output (BIBO) stable system with a pole in the right half of the complex plane.

II. There is no causal and BIBO stable system with a pole in the right half of the complex plane.

Which one among the following is correct?

(A) Both I and II are true
(B) Both I and II are not true
(C) Only I is true
(D) Only II is true

Answer: (D)

24. Which one of the following statements about differential pulse code modulation (DPCM) is true?

(A) The sum of message signal sample with its prediction is quantized
(B) The message signal sample is directly quantized, and its prediction is not used
(C) The difference of message signal sample and a random signal is quantized
(D) The difference of message signal sample with its predictions is quantized

Answer: (D) Click here to watch video explanation

25. Consider a wireless communication link between a transmitter and a receiver located in free space, with finite and strictly positive capacity. If the effective areas of the transmitter and the receiver antennas, and the distance between them are all doubled, and everything else remains unchanged, the maximum capacity of the wireless link

(A) increases by a factor of 2
(B) decrease by a factor 2
(C) remains unchanged
(D) decreases by a factor of $\sqrt{2}$

Answer: (C)

Q. No. 26 to 55 Carry Two Marks Each

26. Starting with x = 1, the solution of the equation $x^3 + x = 1$, after two iterations of Newton-Raphson's method (upto two decimal places) is _____.

Answer: (0.69) Click here to watch video explanation

27. In binary frequency shift keying (FSK), the given signal waveform are

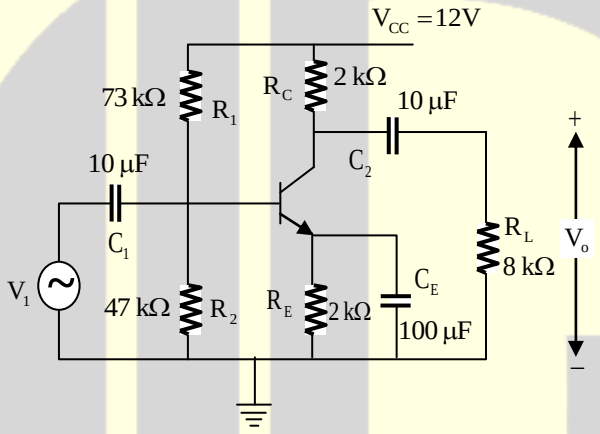
$u_0(t) = 5\cos(20000\pi t); 0 \le t \le T$, and
$u_1(t) = 5\cos(22000\pi t); 0 \le t \le T$,

Where T is the bit-duration interval and t is in seconds. Both $u_0(t)$ and $u_1(t)$ are zero outside the interval $0 \le t \le T$. With a matched filter (correlator) based receiver, the smallest positive value of T (in milliseconds) required to have $u_0(t)$ and $u_1(t)$ uncorrelated is

(A) 0.25ms (B) 0.5ms (C) 0.75ms (D) 1.0ms

Answer: (B) Click here to watch video explanation

28. For the DC analysis of the Common-Emitter amplifier shown, neglect the base current and assume that the emitter and collector current are equal.

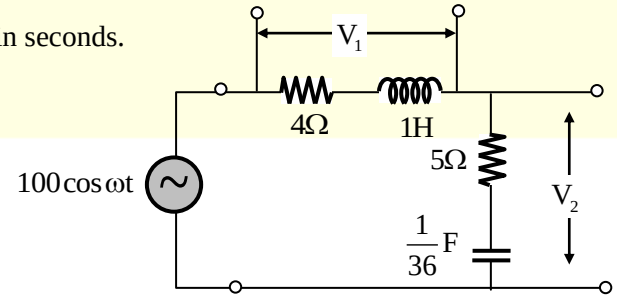


Given that $V_T = 25mV$, $V_{BE} = 0.7V$, and the BJT output resistance r_0 is practically infinite. Under these conditions, the midband voltage gain magnitude $A_V = |V_o/V_i| V/V$, is _____.

Answer: (128) Click here to watch video explanation

29. The figure shows an RLC circuit exited by the sinusoidal voltage $100\cos(3t)$ volts, where t is in seconds.

The ratio $\frac{\text{amplitude of } V_2}{\text{amplitude of } V_1}$ is _____.



Answer: (2.6) Click here to watch video explanation

30. Which one of the following is the general solution of the first order differential equation

$\frac{dy}{dx} = (x + y - 1)^2$, where x, y are real?

(A) $y = 1 + x + \tan^{-1}(x + c)$, where c is a constant

(B) $y = 1 + x + \tan(x + c)$, where c is a constant

(C) $y = 1 - x + \tan^{-1}(x + c)$, where c is a constant

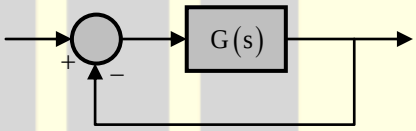
(D) $y = 1 - x + \tan(x + c)$, where c is a constant

Answer: (D) Click here to watch video explanation

31. A linear time invariant (LTI) system with the transfer function

$$G(s) = \frac{k(s^2 + 2s + 2)}{(s^2 - 3s + 2)}$$

is connected in unity feedback configuration as shown in the figure.



For the closed loop system shown, the root locus for $0 < k < \infty$ intersects the imaginary axis for k = 1.5. The closed loop system is stable for

(A) $k > 1.5$

(B) $1 < k < 1.5$

(D) $0 < k < 1$

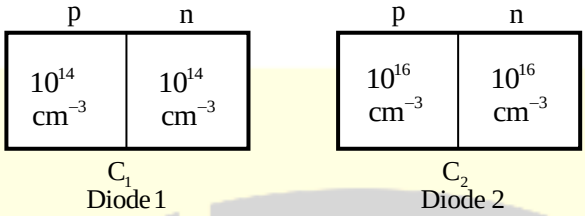
(D) no positive value of k

Answer: (A)

32. Let $I = \int_C (2z\,dx + 2y\,dy + 2x\,dz)$ where x, y, z are real, and let C be the straight line segment from point $A: (0, 2, 1)$ to point $B: (4, 1, -1)$. The value of I is _____.

Answer: (–11) Click here to watch video explanation

33. As shown, two Silicon (Si) abrupt p-n junction diodes are fabricated with uniform donor doping concentration of $N_{D1}=10^{14}\,cm^{-3}$ and $N_{D2}=10^{16}\,cm^{-3}$ in the n-regions of the diodes, and uniform acceptor doping concentration of $N_{A1}=10^{14}\,cm^{-3}$ and $N_{A2}=10^{16}\,cm^{-3}$ in the p-regions of the diodes, respectively.



Assuming that the reverse bias voltage is >> built-in potentials of the diodes, the ratio C_2/C_1 of their reverse bias capacitances for the same applied reverse bias, is _____.

Answer: (10) Click here to watch video explanation

34. An optical fiber is kept along the $\hat{z}$ direction. The refractive indices for the electric fields along $\hat{x}$ and $\hat{y}$ directions in the fiber are $n_x=1.5000$ and $n_y=1.5001$, respectively ($n_x \neq n_y$ due to the imperfection in the fiber cross-section). The free space wavelength of a light wave propagating in the fiber is 1.5μm. If the light wave is circularly polarized at the input of the fiber, the minimum propagation distance after which it becomes linearly polarized, in centimeter, is _____.

Answer: (0.375) Click here to watch video explanation

35. Two discrete-time signals x[n] and h[n] are both non-zero for n = 0, 1, 2 and are zero otherwise. It is given that

$x[0]=1, x[1]=2, x[2]=1, h[0]=1.$

Let y[n] be the linear convolution of x[n] and h[n]. Given that y[1] = 3 and y[2] = 4, the value of the expression $(10y[3]+y[4])$ is _____.

Answer: (31)

36. Which one of the following options correctly describes the locations of the roots of the equation $s^4+s^2+1=0$ on the complex plane?

(A) Four left half plane (LHP) roots

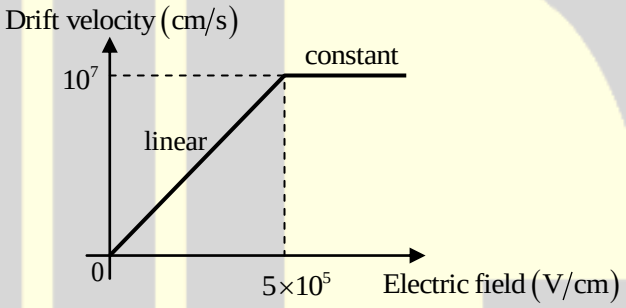
(B) One right half plane (RHP) root, one LHP root and two roots on the imaginary axis

(C) Two RHP roots and two LHP roots

(D) All four roots are on the imaginary axis

Answer: (C)

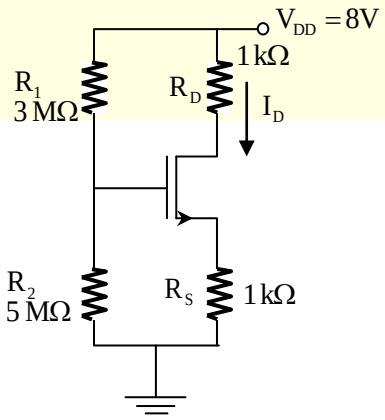
37. The dependence of drift velocity of electrons on electric field in a semiconductor is shown below.



The semiconductor has a uniform electron concentration of $n=1\times10^{16}\,cm^{-3}$ and electronic charge $q=1.6\times10^{-19}\,C$. If a bias of 5V is applied across a 1 μm region of this semiconductor, the resulting current density in this region, in kA/cm^2, is _____.

Answer: (1.6) **Click here to watch video explanation**

38. For the circuit shown, assume that the NMOS transistor is in saturation.



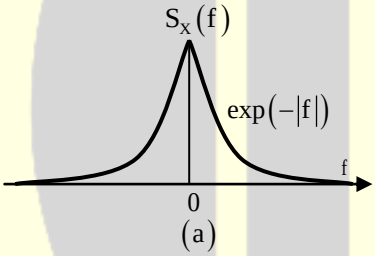
Its threshold voltage $V_{tn} = 1V$ and its transconductance parameter $\mu_n C_{ox}\left(\frac{W}{L}\right) = 1mA/V^2$. Neglect channel length modulation and body bias effects. Under these conditions, the drain current I_D in mA is _____.

Answer: (2) Click here to watch video explanation

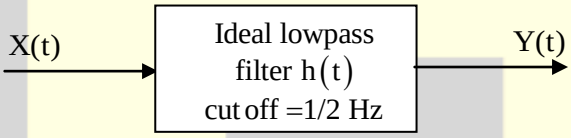
39. Let X(t) be a wide sense stationary random process with the power spectral density $S_X(f)$ as shown in Figure (a), where f is in Hertz (Hz). The random process X(t) is input to an ideal low pass filter with frequency response

$$H(f) = \begin{cases} 1, & |f| \le \frac{1}{2}\text{Hz} \\ 0, & |f| > \frac{1}{2}\text{Hz} \end{cases}$$

As shown in Figure (b). The output of the lowpass filter is $Y(t)$.



(a)



(b)

Let E be the expectation operator and consider the following statements.

I. $E(X(t)) = E(Y(t))$

II. $E(X^2(t)) = E(Y^2(t))$

III. $E(Y^2(t)) = 2$

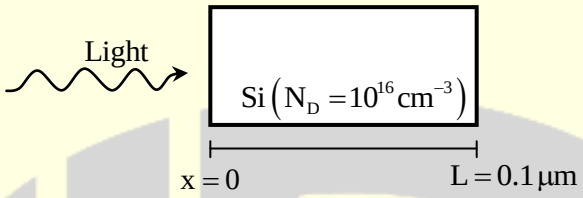
Select the correct option:

(A) only I is true (B) only II and III are true

(C) only I and II are true (D) only I and III are true

Answer: (A) Click here to watch video explanation

40. As shown a uniformly doped Silicon (Si) bar of length L = 0.1 μm with a donor concentration $N_D = 10^{16}\,cm^{-3}$ is illuminated at x = 0 such that electron and hole pairs are generated at the rate of $G_L = G_{L0}\left(1-\frac{x}{L}\right), 0 \le x \le L$, where $G_{L0} = 10^{17}\,cm^{-3}s^{-1}$. Hole lifetime is 10^{-4}s, electronic charge $q = 1.6\times10^{-19}\,C$, hole diffusion coefficient $D_p = 100\,cm^2/s$ and low level injection condition prevails.



Assuming a linearly decaying steady state excess hole concentration that goes to 0 at x = L, the magnitude of the diffusion current density at x = L/2, in A/cm^2, is _____.

Answer: (16) Click here to watch video explanation

41. The Nyquist plot of the transfer function

$$G(s) = \frac{k}{(s^2+2s+2)(s+2)}$$

does not encircle the point(-1+j0) for k = 10 but does encircle the point(-1+j0) for k =100.

Then the closed loop system (having unity gain feedback) is

(A) stable for k = 10 and stable for k = 100

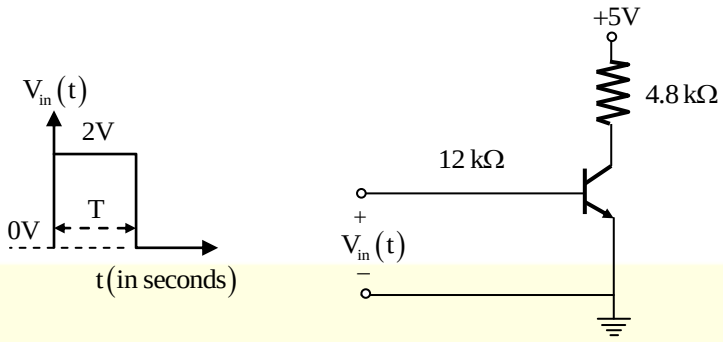
(B) stable for k = 10 and unstable for k = 100

(C) unstable for k = 10 and stable for k =100

(D) unstable for k = 10 and unstable for k = 100

Answer: (B)

42. In the figure shown, the npn transistor acts as a switch



For the input $V_{in}(t)$ as shown in the figure, the transistor switches between the cut-off and saturation regions of operation, when T is large. Assume collector-to-emitter voltage saturation $V_{CE(sat)} = 0.2V$ and base-to-emitter voltage $V_{BE} = 0.7V$. The minimum value of the common-base current gain (α) of the transistor for the switching should be _____.

Answer: **(0.9)** Click here to watch video explanation

43. A three dimensional region R of finite volume is described by

$$x^2 + y^2 \le z^3; 0 \le z \le 1,$$

Where x, y, z are real. The volume of R (up to two decimal places) is _____.

Answer: **(0.79)** Click here to watch video explanation

44. The expression for an electric field in free space is

$$\vec{E} = E_0\left(\hat{x} + \hat{y} + j2\hat{z}\right)e^{-j(\omega t - kx + ky)}$$

Where x, y, z represent the spatial coordinates, t represents time, and ω, k are constants.

This electric field

(A) Does not represent a plane wave

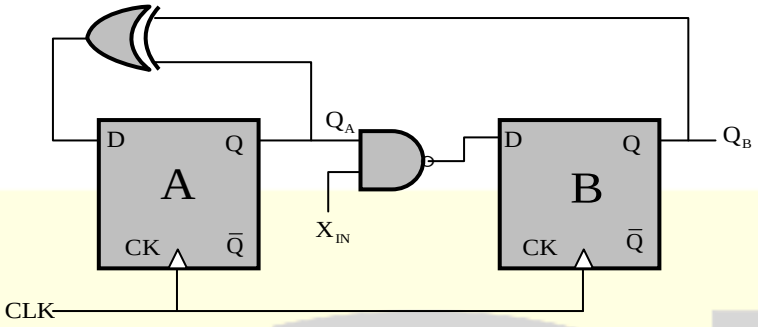
(B) represents a circularly polarized plane wave propagating normal to the z-axis.

(C) represents an elliptically polarized plane wave propagating along the x-y plane.

(D) represents a linearly polarized plane wave.

Answer: **(C)** Click here to watch video explanation

45. A finite state machine (FSM) is implemented using the D flip-flops A and B, and logic gates, as shown in the figure below. The four possible states of the FSM are $Q_AQ_B = 00, 01, 10$ and 11.



Assume that X_{1N} is held at a constant logic level throughout the operation of the FSM. When the FSM is initialized to the state $Q_AQ_B = 00$ and clocked, after a few clock cycles, it starts cycling through

(A) all of the four possible states if $X_{1N} = 1$

(B) three of the four possible states if $X_{1N} = 0$

(C) only two of the four possible states if $X_{IN} = 1$

(D) only two of the four possible states if $X_{1N} = 0$

Answer: (D)

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46. Let x(t) be a continuous time periodic signal with fundamental period T = 1 seconds. Let $[a_k]$ be the complex. Fourier series coefficients of x(t), where k is integer valued. Consider the following statements about x(3t).

I. The complex Fourier series coefficient of x(3t) are $[a_k]$ where k is integer valued

II. The complex Fourier series coefficient of x(3t) are $[3a_k]$ where k is integer valued

III. The fundamental angular frequency of x(3t) is 6π rad/s

For the three statements above which one of the following is correct?

(A) only II and III are true

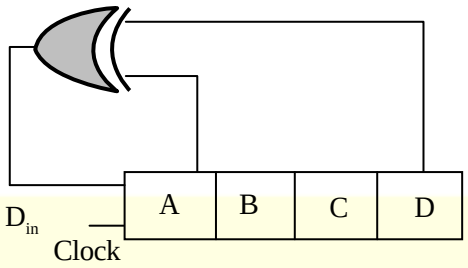
(B) only I and III are true

(C) only III is true

(D) only I is true

Answer: (B)

47. A 4-bit shift register circuit configured for right-shift operation, i.e, $D_{in} \rightarrow A, A \rightarrow B, B \rightarrow C, C \rightarrow D$, is shown.



If the present state of the shift register is ABCD = 1101, the number of clock cycles required to reach the state ABCD = 1111 is _____.

Answer: (10)

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48. Let $f(x) = e^{x+x^2}$ for real x. From among the following, choose the Taylor series approximation of f(x) around x = 0, which includes all powers of x less than or equal to 3.

(A) $1 + x + x^2 + x^3$

(B) $1 + x + \frac{3}{2}x^2 + x^3$

(C) $1 + x + \frac{3}{2}x^2 + \frac{7}{6}x^3$

(D) $1 + x + 3x^2 + 7x^3$

Answer: (C) Click here to watch video explanation

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49. The following FIVE instructions were executed on an 8085 microprocessor.

MVI A, 33H

MVI B, 78H

ADD B

CMA

ANI 32H

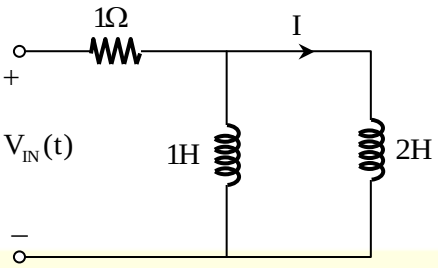
The Accumulator value immediately after the execution of the fifth instruction is

(A) 00H (B) 10H (C) 11H (D) 32H

Answer: (B)

50. In the circuit shown, the voltage $V_{1N}(t)$ is described by:

$$V_{IN} = \begin{cases} 0, & \text{for } t < 0 \\ 15 \text{ volts} & \text{for } t \geq 0 \end{cases}$$



Where t is in seconds. The time (in seconds) at which the current I in the circuit will reach the value 2 Amperes is _____.

Answer: (0.34) Click here to watch video explanation

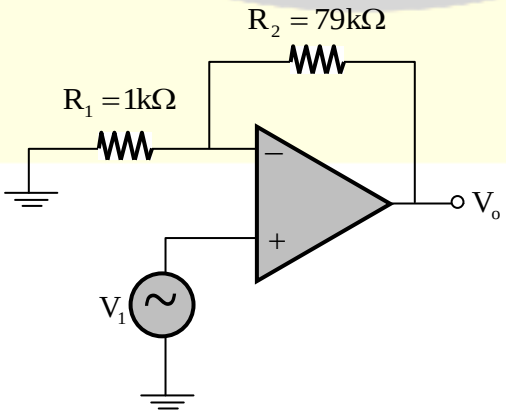
51. A half wavelength dipole is kept in the x-y plane and oriented along 45^o from the x-axis. Determine the direction of null in the radiation pattern for $0 \leq \phi \leq \pi$. Here the angle $\theta(0 \leq \theta < \pi)$ is measured from the z-axis, and the angle $\phi(0 \leq \phi \leq 2\pi)$ is measured from the x-axis in the x-y plane.

(A) $\theta = 90^o, \phi = 45^o$ (B) $\theta = 45^o, \phi = 90^o$

(C) $\theta = 90^o, \phi = 135^o$ (D) $\theta = 45^o, \phi = 135^o$

Answer: (A) Click here to watch video explanation

52. The amplifier circuit shown in the figure is implemented using a compensated operational amplifier (op-amp), and has an open-loop voltage gain, $A_o = 10^5$ V/V and an open-loop cut-off frequency $f_c = 8$Hz.



The voltage gain of the amplifier at 15 kHz, in V/V is _____.

Answer: (44.3) Click here to watch video explanation

53. Let h[n] be the impulse response of a discrete-time linear time invariant (LTI) filter. The impulse response is given by

$h[0]=\frac{1}{3}; h[1]=\frac{1}{3}; h[2]=\frac{1}{3};$ and $h[n]=0$ for $n<0$ and $n>2$.

Let $H(\omega)$ be the discrete-time Fourier system transform (DTFT) of h[n], where ω is the normalized angular frequency in radians. Given that $H(\omega_0)=0$ and $0<\omega_0<\pi$, the value of ω_0 (in radians) is equal to _____.

Answer: (2.094)

54. Which one of the following gives the simplified sum of products expression for the Boolean function $F=m_0+m_2+m_3+m_5$, where m_0, m_2, m_3 and m_5 are minterms corresponding to the inputs A, B and C with A as the MSB and C as the LSB?

(A) $\bar{A}B+\bar{A}\bar{B}\bar{C}+A\bar{B}C$ (B) $\bar{A}\bar{C}+\bar{A}B+A\bar{B}C$

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

Answer: (B)

55. A continuous time signal $x(t)=4\cos(200\pi t)+8\cos(400\pi t)$, where t is in seconds, is the input to a linear time invariant (LTI) filter with the impulse response

$$h(t)=\begin{cases}\frac{2\sin(300\pi t)}{\pi t}, & t\neq 0\\ 600, & t=0\end{cases}$$

Let y(t) be the output of this filter. The maximum value of $|y(t)|$ is _____.

Answer: (B)

★★★ END OF THE PAPER ★★★