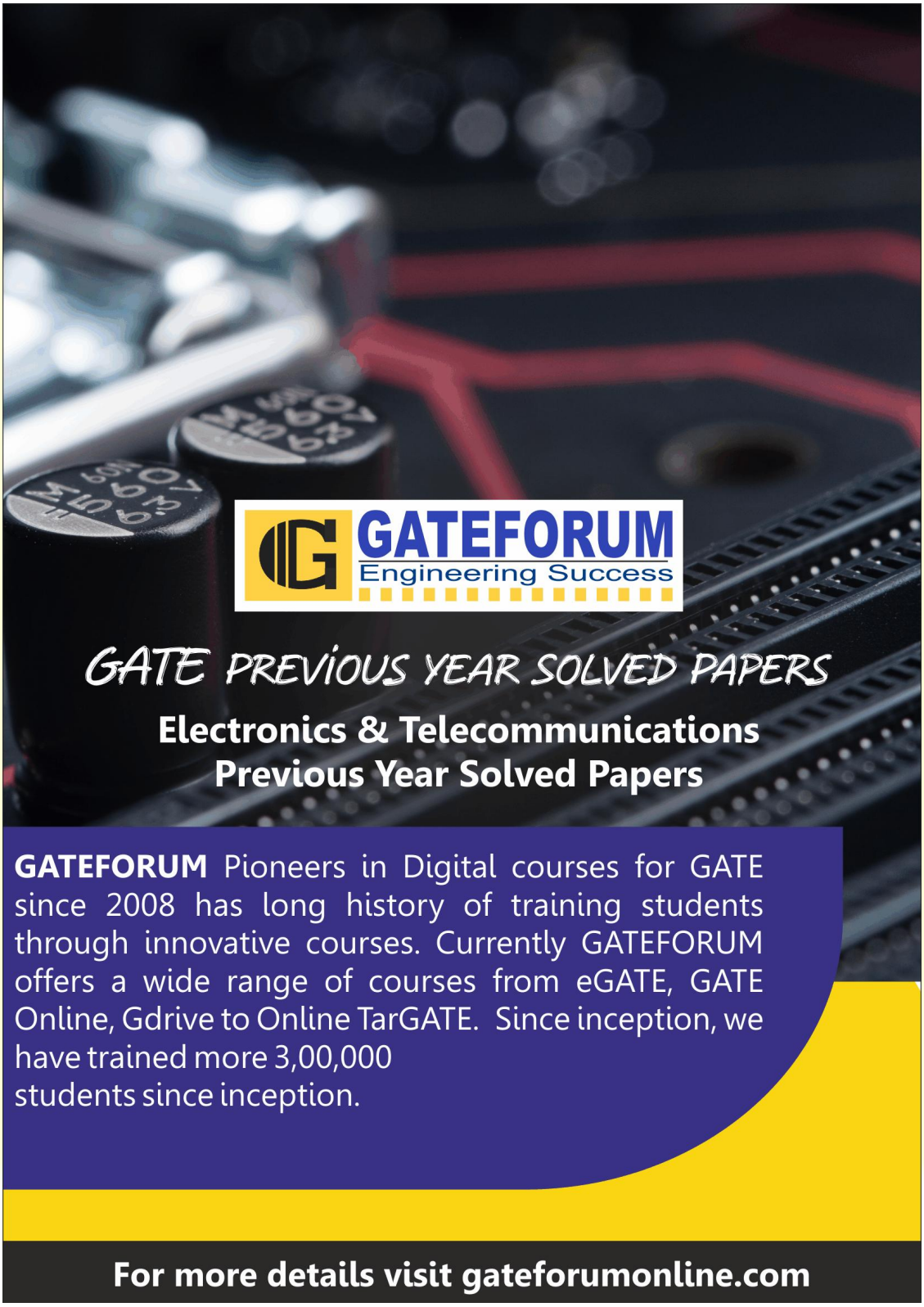

GENERAL APTITUDE

Q. No. 1 - 5 Carry One Mark Each

1. "I cannot support this proposal. My_____will not permit it."

(A) conscious (B) consensus

(C) conscience (D) consent

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

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2. Courts :: : Parliament : Legislature

(By word meaning)

(A) Judiciary (B) Executive

(C) Governmental (D) Legal

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

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3. What is the smallest number with distinct digits whose digits add up to 45?

(A) 123555789 (B) 123457869

(C) 123456789 (D) 99999

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

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4. In a class of 100 students,

(i) there are 30 students who neither like romantic movies nor comedy movies,

(ii) the number of students who like romantic movies is twice the number ofstudents who like comedy movies, and

(iii) the number of students who like both romantic movies and comedy movies is 20.

How many students in the class like romantic movies?

(A) 40 (B) 20 (C) 60 (D) 30

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

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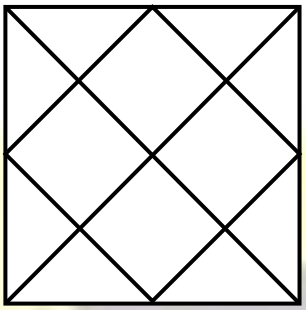
5. How many rectangles are present in the given figure?



(A) 8 (B) 9 (C) 10 (D) 12

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

Q. No. 6-10 Carry Two Marks Each

6. Forestland is a planet inhabited by different kinds of creatures. Among other creatures, it is populated by animals all of whom are ferocious. There are also creatures that have claws, and some that do not. All creatures that have claws are ferocious.

Based only on the information provided above, which one of the following options can be logically inferred with certainty?

(A) All creatures with claws are animals.

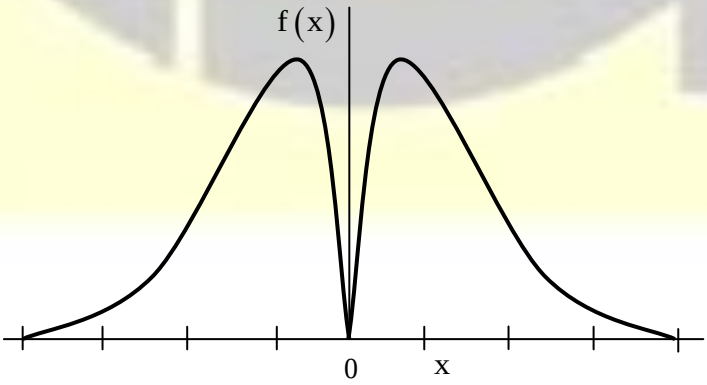
(B) Some creatures with claws are non-ferocious.

(C) Some non-ferocious creatures have claws.

(D) Some ferocious creatures are creatures with claws.

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

7. Which one of the following options represents the given graph?



(A) $f(x)=x^2 2^{-|x|}$ (B) $f(x)=x2^{-|x|}$

(C) $f(x)=|x|2^{-x}$ (D) $f(x)=x2^{-x}$

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

8. Which one of the following options can be inferred from the given passage alone?

When I was a kid, I was partial to stories about other worlds and interplanetary travel. I used to imagine that I could just gaze off into space and be whisked to another planet.

[Excerpt from The Truth about Stories by T. King]

(A) It is a child's description of what he or she likes.

(B) It is an adult's memory of what he or she liked as a child.

(C) The child in the passage read stories about interplanetary travel only in parts.

(D) It teaches us that stories are good for children.

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

9. Out of 1000 individuals in a town, 100 unidentified individuals are covid positive. Due to lack of adequate covid-testing kits, the health authorities of the town devised a strategy to identify these covid-positive individuals. The strategy is to:

(i) Collect saliva samples from all 1000 individuals and randomly group them into sets of 5.

(ii) Mix the samples within each set and test the mixed sample for covid.

(iii) If the test done in (ii) gives a negative result, then declare all the 5individuals to be covid negative.

(iv) If the test done in (ii) gives a positive result, then all the 5 individuals are separately tested for covid.

Given this strategy, no more than_____testing kits will be required to identify all the 100 covid positive individuals irrespective of how they are grouped.

(A) 700 (B) 600 (C) 800 (D) 1000

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

10. A 100 cm × 32 cm rectangular sheet is folded 5 times. Each time the sheet is folded, the long edge aligns with its opposite side. Eventually, the folded sheet is a rectangle of dimensions 100 cm × 1 cm.

The total number of creases visible when the sheet is unfolded is

(A) 32 (B) 5 (C) 31 (D) 63

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

ELECTRONICS AND COMMUNICATIONS

Q. No. 11 to 35 Carry One Mark Each

11. Let $v_1 = \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix}$ and $v_2 = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$ be two vectors. The value of the coefficient α in the expression $v_1 = \alpha v_2 + e$, which minimizes the length of the error vector e, is

(A) $\frac{7}{2}$ (B) $\frac{-2}{7}$ (C) $\frac{2}{7}$ (D) $\frac{-7}{2}$

Answer: (C) Click here to watch video explanation

12. The rate of increase, of a scalar field f(x, y, z) = xyz, in the direction v = (2, 1, 2) at a point (0, 2, 1) is

(A) $\frac{2}{3}$ (B) $\frac{4}{3}$ (C) 2 (D) 4

Answer: (B) Click here to watch video explanation

13. Let $w^4 = 16j$. Which of the following cannot be a value of w?

(A) $2e^{\frac{j2\pi}{8}}$ (B) $2e^{\frac{j\pi}{8}}$ (C) $2e^{\frac{j5\pi}{8}}$ (D) $2e^{\frac{j9\pi}{8}}$

Answer: (A) Click here to watch video explanation

14. The value of the contour integral, $\oint_C \left(\frac{z+2}{z^2+2z+2} \right) dz$, where the contour C is $\left\{ z : \left| z+1-\frac{3}{2}j \right| = 1 \right\}$, taken in the counter clockwise direction, is

(A) $-\pi(1+j)$ (B) $\pi(1+j)$ (C) $\pi(1-j)$ (D) $-\pi(1-j)$

Answer: (B) Click here to watch video explanation

15. Let the sets of eigen values and eigenvectors of a matrix B be $\{\lambda_k \mid 1 \le k \le n\}$ and $\{v_k \mid 1 \le k \le n\}$, respectively. For any invertible matrix P, the sets of eigenvalues and eigenvectors of the matrix A, where $B = P^{-1}AP$, respectively, are

(A) $\{\lambda_k \det(A) \mid 1 \le k \le n\}$ and $\{Pv_k \mid 1 \le k \le n\}$ (B) $\{\lambda_k \mid 1 \le k \le n\}$ and $\{v_k \mid 1 \le k \le n\}$

(C) $\{\lambda_k \mid 1 \le k \le n\}$ and $\{Pv_k \mid 1 \le k \le n\}$ (D) $\{\lambda_k \mid 1 \le k \le n\}$ and $\{P^{-1}v_k \mid 1 \le k \le n\}$

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

16. In a semiconductor, if the Fermi energy level lies in the conduction band, then the semiconductor is known as

(A) degenerate n-type (B) degenerate p-type

(C) non-degenerate n-type (D) non-degenerate p-type

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

17. For an intrinsic semiconductor at temperature T = 0 K, which of thefollowing statement is true?

(A) All energy states in the valence band are filled with electrons and all energy states in the conduction band are empty of electrons.

(B) All energy states in the valence band are empty of electrons and all energy states in the conduction band are filled with electrons.

(C) All energy states in the valence and conduction band are filled with holes.

(D) All energy states in the valence and conduction band are filled with electrons.

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

18. A series RLC circuit has a quality factor Q of 1000 at a center frequency of 10^6 rad/s. The possible values of R, L and C are

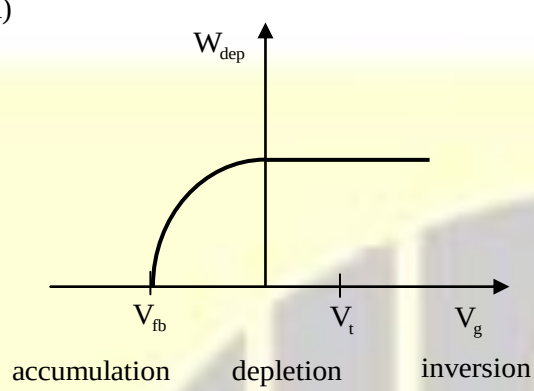
(A) $R = 1\,\Omega$, $L = 1\,\mu H$ and $C = 1\,\mu F$ (B) $R = 0.1\,\Omega$, $L = 1\,\mu H$ and $C = 1\,\mu F$

(C) $R = 0.01\,\Omega$, $L = 1\,\mu H$ and $C = 1\,\mu F$ (D) $R = 0.001\,\Omega$, $L = 1\,\mu H$ and $C = 1\,\mu F$

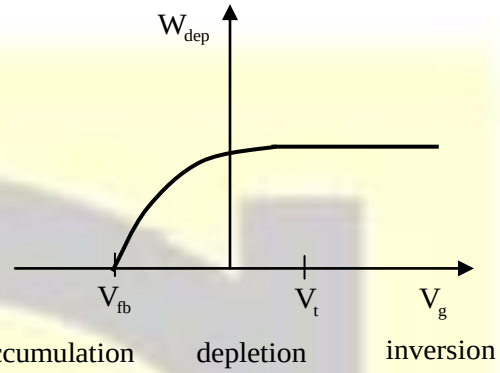
Answer: (D) **Click here to watch video explanation**

19. For a MOS capacitor, V_{fb} and V_t are the flat-band voltage and the threshold voltage, respectively. The variation of the depletion width (W_{dep}) for varying gate voltage (V_g) is best represented by

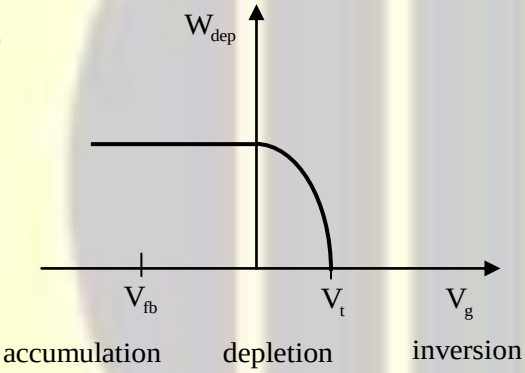
(A)



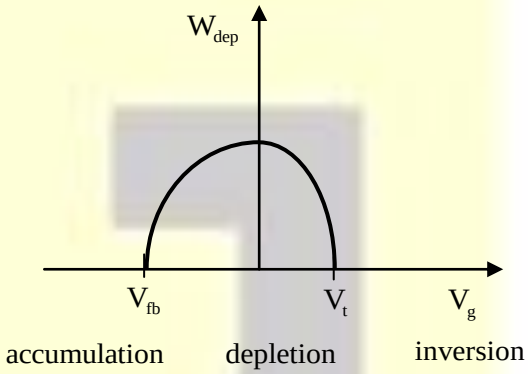
(B)



(C)



(D)



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

20. Consider a narrow band signal, propagating in a lossless dielectric medium $(\varepsilon_r = 4, \mu_r = 1)$, with phase velocity v_p and group velocity v_g. Which of the following statement is true? (c is the velocity of light in vacuum.)

(A) $v_p > c, v_g > c$

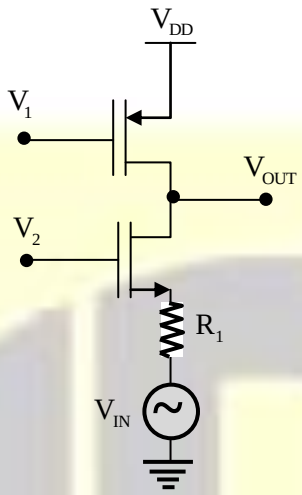
(B) $v_p < c, v_g > c$

(C) $v_p > c, v_g < c$

(D) $v_p < c, v_g < c$

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

21. In the circuit shown below, V_1 and V_2 are bias voltages. Based on input and output impedances, the circuit behaves as a



(A) voltage controlled voltage source
(B) voltage controlled current source
(C) current controlled voltage source
(D) current controlled current source

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

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22. A cascade of common-source amplifiers in a unity gain feedback configuration oscillates when

(A) the closed loop gain is less than 1 and the phase shift is less than 180°.
(B) the closed loop gain is greater than 1 and the phase shift is less than 180°.
(C) the closed loop gain is less than 1 and the phase shift is greater than 180°.
(D) the closed loop gain is greater than 1 and the phase shift is greater than 180°.

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

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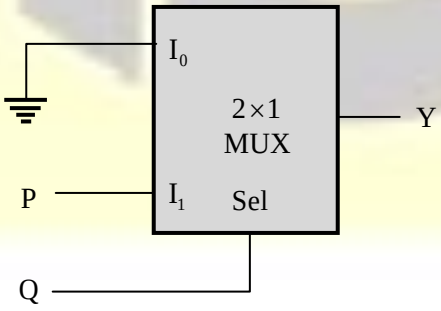
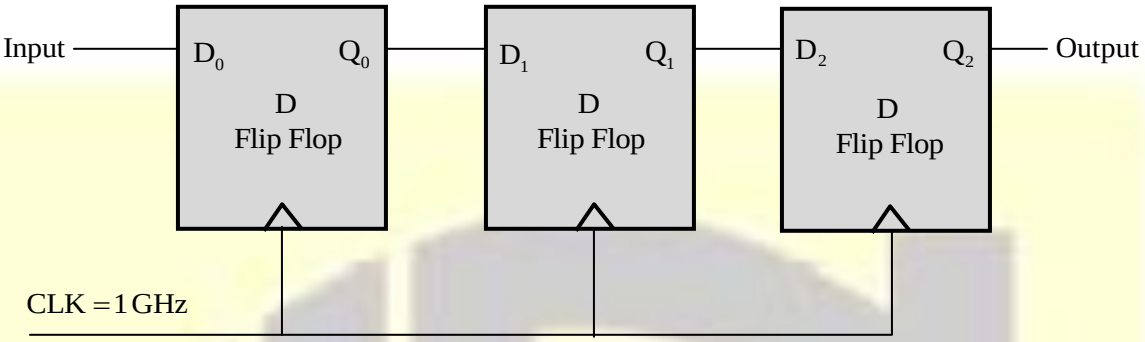
23. In the circuit shown below, P and Q are the inputs. The logical function realized by the circuit shown below is



(A) $Y = PQ$ (B) $Y = P + Q$ (C) $Y = \overline{PQ}$ (D) $Y = \overline{P + Q}$

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

24. The synchronous sequential circuit shown below works at a clock frequency of1 GHz. The throughput, in Mbits/s, and the latency, in ns, respectively, are



(A) 1000, 3 (B) 333.33, 1 (C) 2000, 3 (D) 333.33, 3

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

25. The open loop transfer function of a unity negative feedback system is $G(s)=\frac{k}{s(1+sT_1)(1+sT_2)}$, where k, T_1 and T_2 are positive constants. The phase cross over frequency, in rad/s, is

(A) $\frac{1}{\sqrt{T_1T_2}}$ (B) $\frac{1}{T_1T_2}$ (C) $\frac{1}{T_1\sqrt{T_2}}$ (D) $\frac{1}{T_2\sqrt{T_1}}$

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

26. Consider a system with inputx(t) and output $y(t)=x(e^t)$. The system is

(A) Causal and time invariant (B) Non-causal and time varying
(C) Causal and time varying (D) Non-causal and time invariant

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

27. Let m(t) be a strictly band-limited signal with bandwidth B and energy E. Assuming $\omega_0 = 10\,B$, the energy in the signal $m(t)\cos\omega_0 t$ is

(A) $\frac{E}{4}$ (B) $\frac{E}{2}$ (C) E (D) 2E

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

28. The Fourier transform $X(\omega)$ of $x(t) = e^{-t^2}$ is

Note: $\int_{-\infty}^{\infty} e^{-y^2} dy = \sqrt{\pi}$

(A) $\sqrt{\pi} e^{\frac{\omega^2}{2}}$ (B) $\frac{e^{-\frac{\omega^2}{4}}}{2\sqrt{\pi}}$ (C) $\sqrt{\pi} e^{-\frac{\omega^2}{4}}$ (D) $\sqrt{\pi} e^{-\frac{\omega^2}{2}}$

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

29. In the table shown below, match the signal type with its spectral characteristics.

Signal type	Spectral characteristics
(i) Continuous, aperiodic	(a) Continuous, aperiodic
(ii) Continuous, periodic	(b) Continuous, periodic
(iii) Discrete, aperiodic	(c) Discrete, aperiodic
(iv) Discrete, periodic	(d) Discrete, periodic

(A) (i)-(a), (ii)-(b), (iii)-c, (iv)-(d) (B) (i)-(a), (ii)-(c), (iii)-(b), (iv)-(d)

(C) (i)-(d), (ii)-(b), (iii)-c, (iv)-(a) (D) (i)-(a), (ii)-(c), (iii)-(d), (iv)-(b)

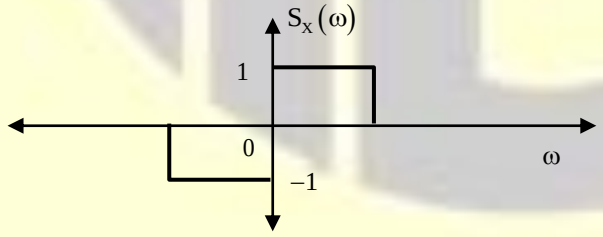
Answer: (B) **Click here to watch video explanation**

30. For a real signal, which of the following is/are valid power spectral density/densities?

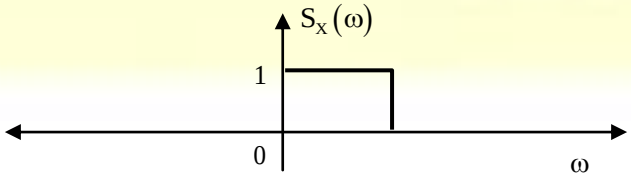
(A) $S_x(\omega) = \frac{2}{9+\omega^2}$

(B) $S_x(\omega) = e^{-\omega^2} \cos^2 \omega$

(C)



(D)

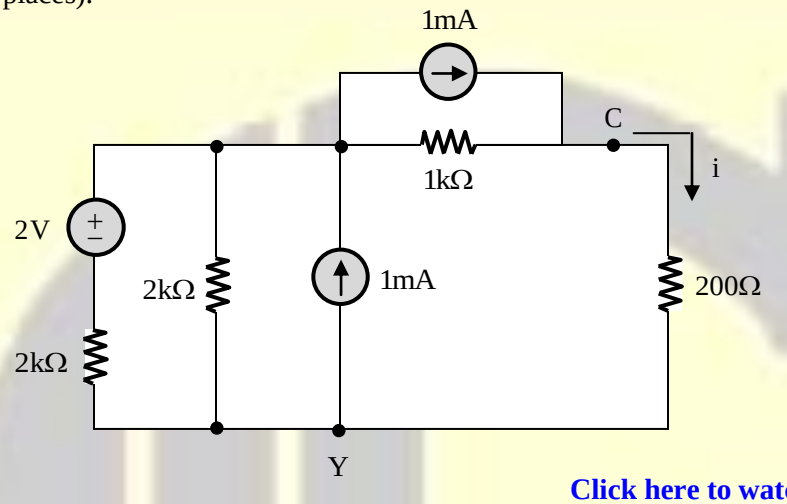


Answer: (A, B) **Click here to watch video explanation**

31. The signal-to-noise ratio (SNR) of an ADC with a full-scale sinusoidal input is given to be 61.96 dB. The resolution of the ADC is_____bits (rounded off to the nearest integer).

Answer: (10) **Click here to watch video explanation**

32. In the circuit shown below, the current i flowing through 200 Ω resistor is_____mA (rounded off to two decimal places).

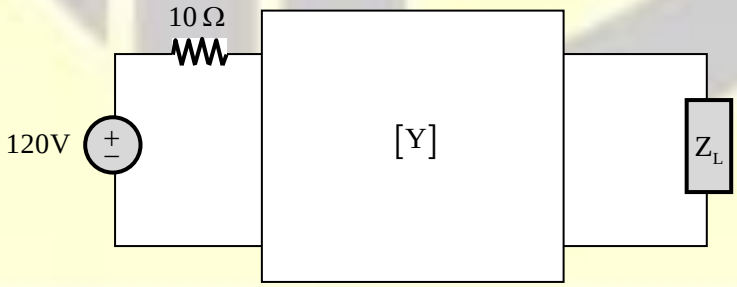


Answer: (1.36) **Click here to watch video explanation**

33. For the two port network shown below, the [Y]-parameters is given as

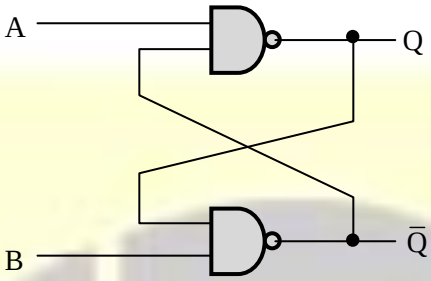
$$[Y]=\frac{1}{100}\begin{bmatrix}2 & -1\\ -1 & 4/3\end{bmatrix}S$$

The value of load impedance Z_L, in Ω, for maximum power transfer will be____(rounded off to the nearest integer).



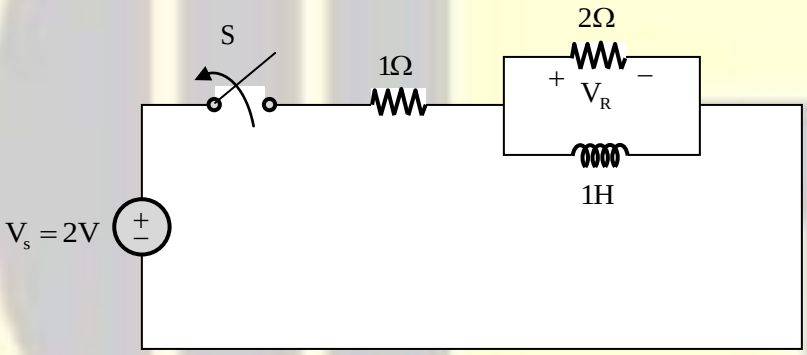
Answer: (80) **Click here to watch video explanation**

34. For the circuit shown below, the propagation delay of each NAND gate is 1 ns. The critical path delay, in ns, is _____ (rounded off to the nearest integ**er).**



Answer: (2) **Click here to watch video explanation**

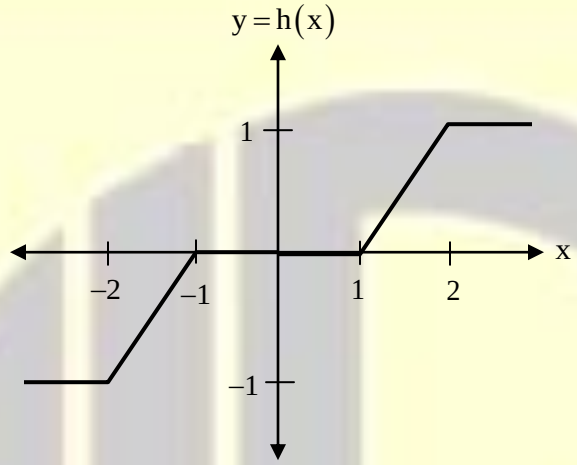
35. In the circuit shown below, switch S was closed for a long time. If the switch is opened at t = 0, the maximum magnitude of the voltage V_R, in volts, is_____(rounded off to the nearest integ**er).**



Answer: (4) **Click here to watch video explanation**

Q. No. 36-65 Carry Two Marks Each

36. A random variable X, distributed normally as N(0,1), undergoes the transformation Y = h(X), given in the figure. The form of the probability density function of Y is(In the options given below, a, b, c are non-zero constants and g(y) is piece-wise continuous function)



(A) $a\delta(y-1)+b\delta(y+1)+g(y)$ (B) $a\delta(y+1)+b\delta(y)+c\delta(y-1)+g(y)$

(C) $a\delta(y+2)+b\delta(y)+c\delta(y-2)+g(y)$ (D) $a\delta(y+2)+b\delta(y-2)+g(y)$

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

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37. The value of the line integral $\int_P^Q \left(z^2dx+3y^2dy+2xzdz\right)$ along the straight linejoining the points P(1,1,2) and Q(2,3,1) is

(A) 20 (B) 24 (C) 29 (D) –5

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

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38. Let x be an n × 1 real column vector with length $\ell=\sqrt{x^Tx}$. The trace of the matrix $P=xx^T$ is

(A) ℓ^2 (B) $\frac{\ell^2}{4}$ (C) ℓ (D) $\frac{\ell^2}{2}$

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

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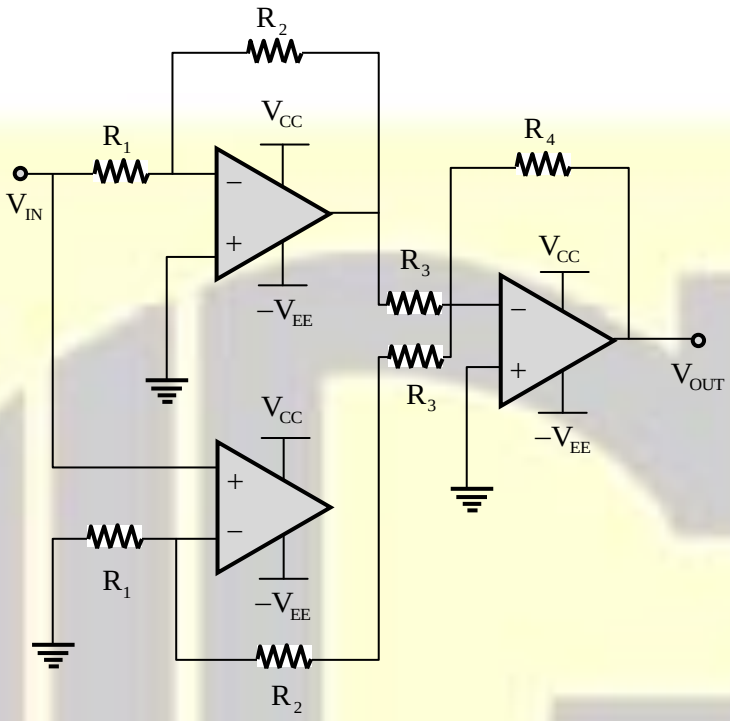
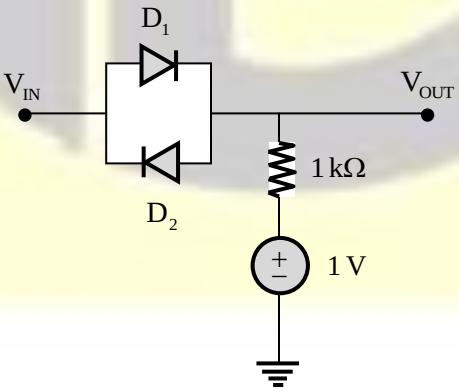
39. The $\frac{V_{OUT}}{V_{IN}}$ of the circuit shown below is



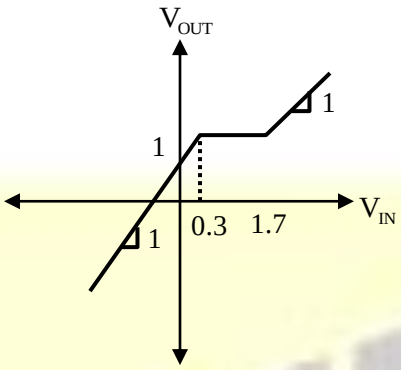
(A) $-\frac{R_4}{R_3}$ (B) $\frac{R_4}{R_3}$ (C) $1+\frac{R_4}{R_3}$ (D) $1-\frac{R_4}{R_3}$

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

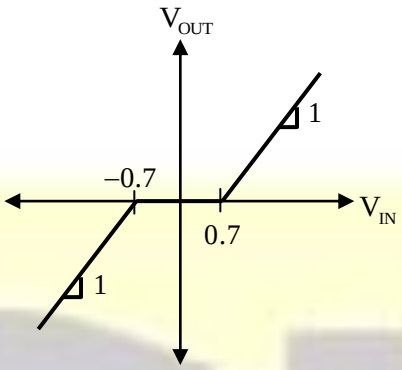
40. In the circuit shown below, D_1 and D_2 are silicon diodes with cut-in voltage of 0.7 V. V_{IN} and V_{OUT} are input and output voltages in volts. The transfer characteristic is



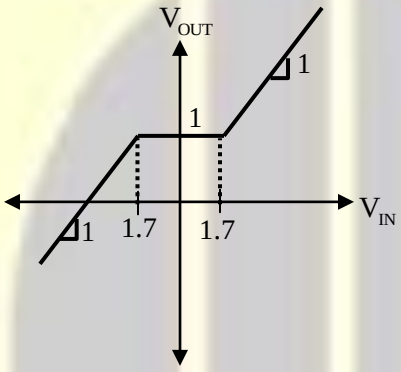
(A)



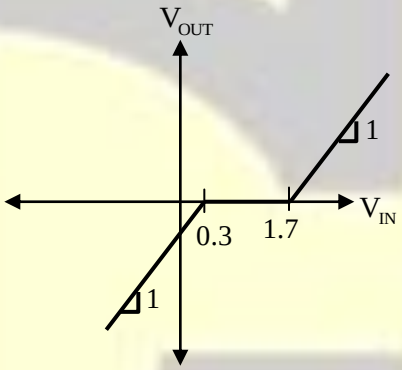
(B)



(C)

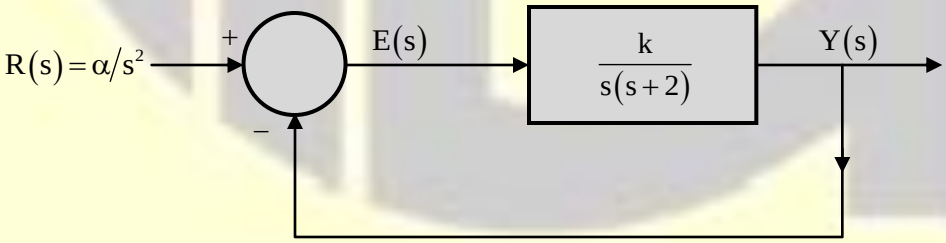


(D)



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

41. A closed loop system is shown in the figure where $k > 0$ and $\alpha > 0$. The steady state error due to a ramp input $\left(R(s) = \alpha/s^2\right)$ is given by

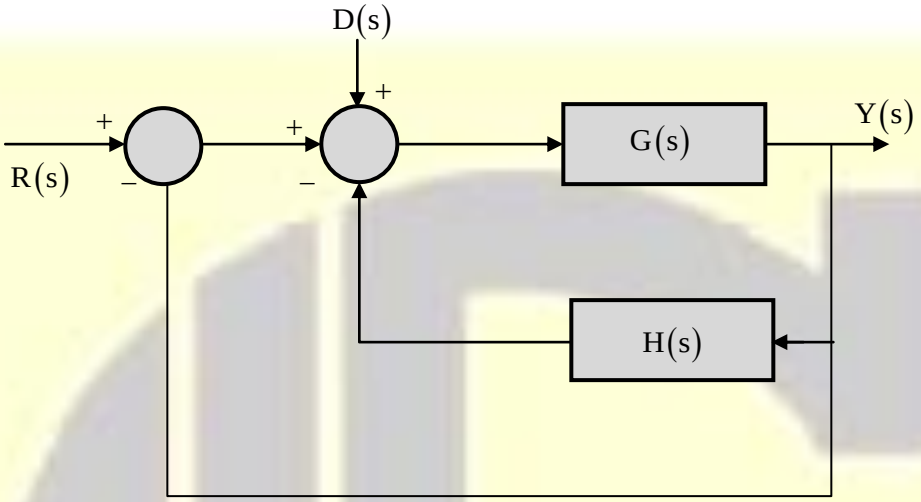


(A) $\frac{2\alpha}{k}$ (B) $\frac{\alpha}{k}$ (C) $\frac{\alpha}{2k}$ (D) $\frac{\alpha}{4k}$

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

42. In the following block diagram, R(s) and D(s) are two inputs. The output Y(s) is expressed as $Y(s)=G_1(s)R(s)+G_2(s)D(s)$.

$G_1(s)$ and $G_2(s)$ are given by



(A) $G_1(s)=\dfrac{G(s)}{1+G(s)+G(s)H(s)}$ and $G_2(s)=\dfrac{G(s)}{1+G(s)+G(s)H(s)}$

(B) $G_1(s)=\dfrac{G(s)}{1+G(s)+H(s)}$ and $G_2(s)=\dfrac{G(s)}{1+G(s)+H(s)}$

(C) $G_1(s)=\dfrac{G(s)}{1+G(s)+H(s)}$ and $G_2(s)=\dfrac{G(s)}{1+G(s)+G(s)H(s)}$

(D) $G_1(s)=\dfrac{G(s)}{1+G(s)+G(s)H(s)}$ and $G_2(s)=\dfrac{G(s)}{1+G(s)+H(s)}$

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

43. The state equation of a second order system is

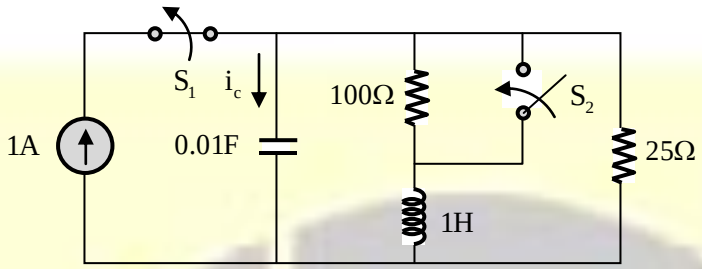
$\dot{x}(t)=Ax(t)$, $x(0)$ is the initial condition.

Suppose λ_1 and λ_2 are two distinct eigen values of A and v_1 and v_2 are the corresponding eigenvectors. For constants α_1 and α_2, the solution, x(t), of the state equation is

(A) $\sum_{i=1}^{2}\alpha_i e^{\lambda_i t}v_i$ (B) $\sum_{i=1}^{2}\alpha_i e^{2\lambda_i t}v_i$ (C) $\sum_{i=1}^{2}\alpha_i e^{3\lambda_i t}v_i$ (D) $\sum_{i=1}^{2}\alpha_i e^{4\lambda_i t}v_i$

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

44. The switch S_1 was closed and S_2 was open for a long time. At t = 0, switch S_1 is opened and S_2 is closed, simultaneously. The value of $i_c\left(0^+\right)$, in amperes, is



(A) 1 (B) –1 (C) 0.2 (D) 0.8

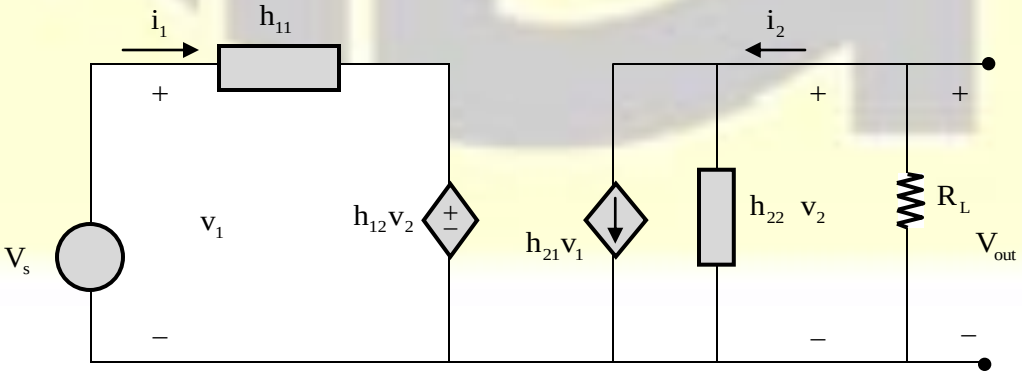
Answer: (B) Click here to watch video explanation

45. Let a frequency modulated (FM) signal $x(t)=A\cos\left(\omega_c t+k_f\int_{-\infty}^{t}m(\lambda)d(\lambda)\right)$, where m(t) is a message signal of bandwidth W. It is passed through a non –linear system with output $y(t)=2x(t)+5\left(x(t)\right)^2$. Let B_T denote the FM bandwidth. The minimum value of ω_c required to recover x(t) from y(t) is

(A) B_T+W (B) $\frac{3}{2}B_T$ (C) $2B_T+W$ (D) $\frac{5}{2}B_T$

Answer: (B) Click here to watch video explanation

46. The h-parameters of a two port network are shown below. The condition for the maximum small signal voltage gain $\frac{V_{out}}{V_s}$ is



(A) $h_{11}=0, h_{12}=0, h_{21}=$ very high and $h_{22}=0$

(B) $h_{11}=$ very high, $h_{12}=0, h_{21}=$ very high and $h_{22}=0$

(C) $h_{11}=0, h_{12}=$ very high, $h_{21}=$ very high and $h_{22}=0$

(D) $h_{11}=0, h_{12}=0, h_{21}=$ very high and $h_{22}=$ very high

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

47. Consider a discrete-time periodic signal with period N = 5. Let the discrete-time Fourier series (DTFS) representation be $x[n]=\sum_{k=0}^{4} a_k e^{\frac{jk2\pi n}{5}}$, where $a_0=1, a_1=3j, a_2=2j, a_3=-2j$ and $a_4=-3j$. The value of the sum $\sum_{n=0}^{4} x[n]\sin\frac{4\pi n}{5}$ is

(A) –10 (B) 10 (C) –2 (D) 2

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

48. Let an input x[n] having discrete time Fourier transform $X\left(e^{j\Omega}\right)=1-e^{-j\Omega}+2e^{-3j\Omega}$ be passed through an LTI system. The frequency response of the LTI system is $H\left(e^{j\Omega}\right)=1-\frac{1}{2}e^{-j2\Omega}$. The output $y[n]$ of the system is

(A) $\delta[n]+\delta[n-1]-\frac{1}{2}\delta[n-2]-\frac{5}{2}\delta[n-3]+\delta[n-5]$

(B) $\delta[n]-\delta[n-1]-\frac{1}{2}\delta[n-2]-\frac{5}{2}\delta[n-3]+\delta[n-5]$

(C) $\delta[n]-\delta[n-1]-\frac{1}{2}\delta[n-2]+\frac{5}{2}\delta[n-3]-\delta[n-5]$

(D) $\delta[n]+\delta[n-1]+\frac{1}{2}\delta[n-2]+\frac{5}{2}\delta[n-3]+\delta[n-5]$

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

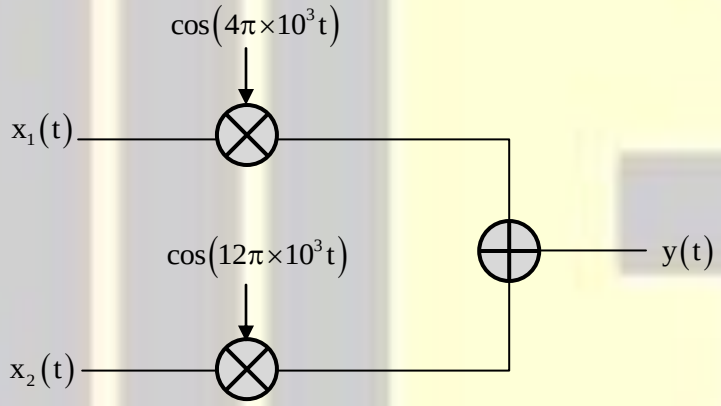
49. Let $x(t)=10\cos(10.5Wt)$ be passed through an LTI system having impulse response $h(t)=\pi\left(\frac{\sin Wt}{\pi t}\right)^2\cos 10Wt$. The output of the system is

(A) $\left(\frac{15W}{4}\right)\cos(10.5Wt)$ (B) $\left(\frac{15W}{2}\right)\cos(10.5Wt)$

(C) $\left(\frac{15W}{8}\right)\cos(10.5Wt)$ (D) $(15W)\cos(10.5Wt)$

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

50. Let $x_1(t)$ and $x_2(t)$ be two band-limited signals having bandwidth $B=4\pi\times10^3$ rad/s each. In the figure below, the Nyquist sampling frequency, in rad/s, required to sample y(t), is



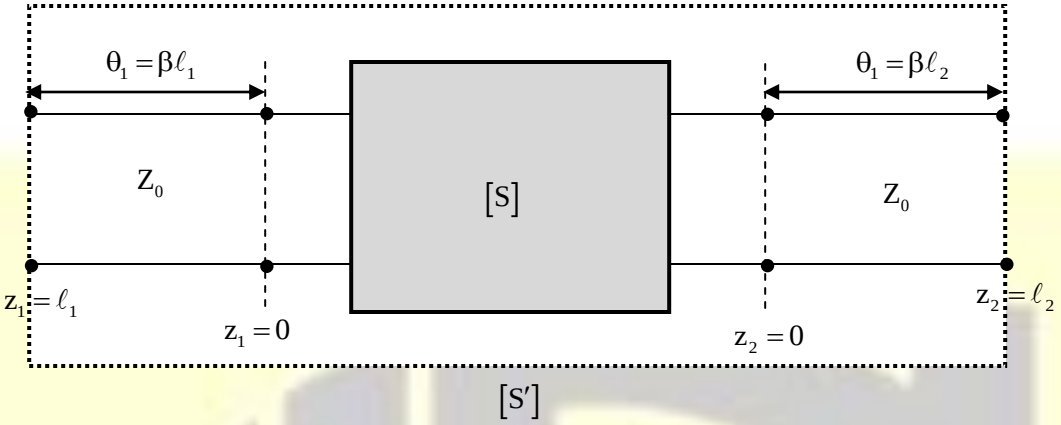
(A) $20\pi\times10^3$ (B) $40\pi\times10^3$ (C) $8\pi\times10^3$ (D) $32\pi\times10^3$

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

51. The S-parameters of a two port network is given as

$$[S]=\begin{bmatrix}S_{11} & S_{12}\\ S_{21} & S_{22}\end{bmatrix}$$

With reference to Z_0. Two lossless transmission line sections of electrical lengths $\theta_1=\beta\ell_1$ and $\theta_2=\beta\ell_2$ are added to the input and output ports for measurement purposes, respectively. The S-parameters $[S']$ of the resultant two port network is



(A) $\begin{bmatrix} S_{11}e^{-j2\theta_1} & S_{12}e^{-j(\theta_1+\theta_2)} \\ S_{21}e^{-j(\theta_1+\theta_2)} & S_{22}e^{-j2\theta_2} \end{bmatrix}$

(B) $\begin{bmatrix} S_{11}e^{j2\theta_1} & S_{12}e^{-j(\theta_1+\theta_2)} \\ S_{21}e^{-j(\theta_1+\theta_2)} & S_{22}e^{j2\theta_2} \end{bmatrix}$

(C) $\begin{bmatrix} S_{11}e^{j2\theta_1} & S_{12}e^{j(\theta_1+\theta_2)} \\ S_{21}e^{j(\theta_1+\theta_2)} & S_{22}e^{j2\theta_2} \end{bmatrix}$

(D) $\begin{bmatrix} S_{11}e^{-j2\theta_1} & S_{12}e^{j(\theta_1+\theta_2)} \\ S_{21}e^{j(\theta_1+\theta_2)} & S_{22}e^{-j2\theta_2} \end{bmatrix}$

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

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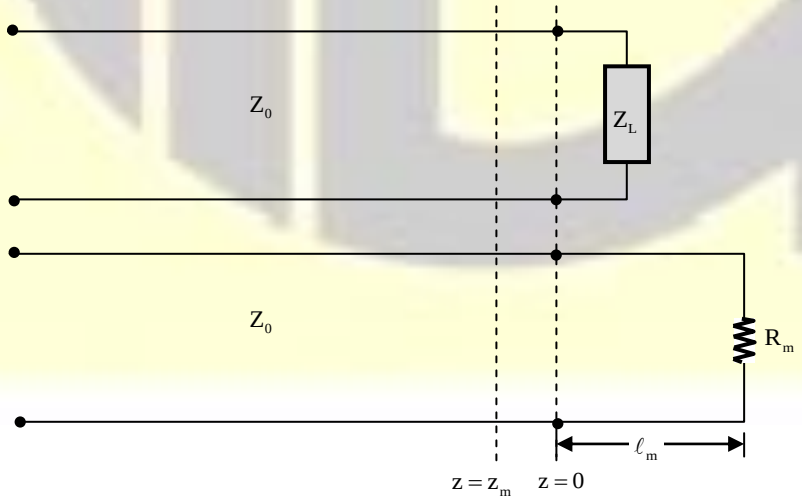
52. The standing wave ratio on a 50 Ω lossless transmission line terminated in an unknown load impedance is found to be 2.0. The distance between successive voltage minima is 30 cm and the first minimum is located at 10 cm from the load. Z_L can be replaced by an equivalent length ℓ_m and terminating resistance R_m of the same line. The value of R_m and ℓ_m, respectively, are



(A) $R_m = 100\Omega,\ \ell_m = 20\,\text{cm}$ (B) $R_m = 25\,\Omega,\ \ell_m = 20\,\text{cm}$

(C) $R_m = 100\,\Omega,\ \ell_m = 5\,\text{cm}$ (D) $R_m = 25\,\Omega,\ \ell_m = 5\,\text{cm}$

Answer: (B, C) Click here to watch video explanation

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53. The electric field of a plane electromagnetic wave is

$$E = a_x C_{1x}\cos(\omega t - \beta z) + a_y C_{1y}\cos(\omega t - \beta z + \theta)\ \text{V/m}.$$

Which of the following combination(s) will give rise to a left handed elliptically polarized (LHEP) wave?

(A) $C_{1x} = 1, C_{1y} = 1, \theta = \frac{\pi}{4}$ (B) $C_{1x} = 2, C_{1y} = 1, \theta = \frac{\pi}{2}$

(C) $C_{1x} = 1, C_{1y} = 2, \theta = \frac{3\pi}{2}$ (D) $C_{1x} = 2, C_{1y} = 1, \theta = \frac{3\pi}{4}$

Answer: (A, B, D) Click here to watch video explanation

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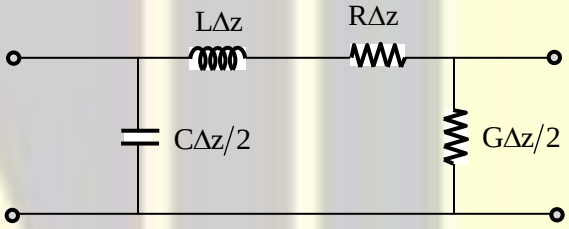
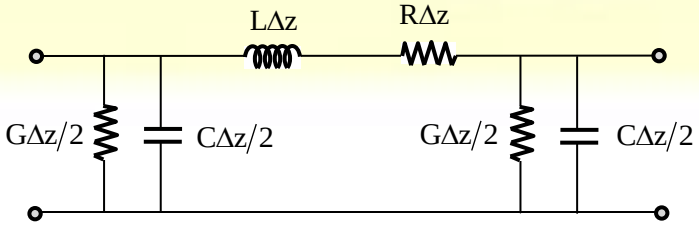
54. The following circuit(s) representing alumpedelement equivalent of an infinitesimal section of a transmission line is/are

(A)

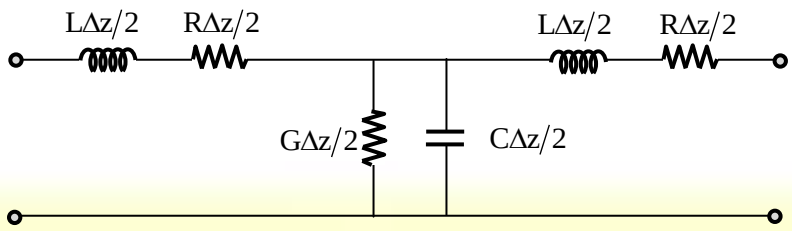


(B)

(C)

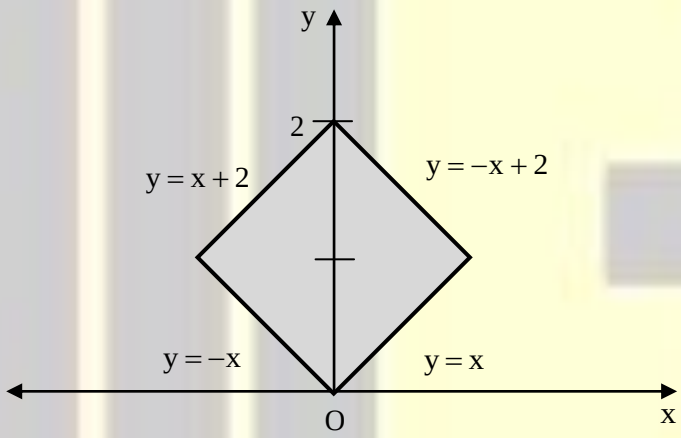


(D)



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

55. The value of the integral $\iint_R xy\,dx\,dy$ over the region R, given in the figure, is _____ (rounded off to the nearest integer).

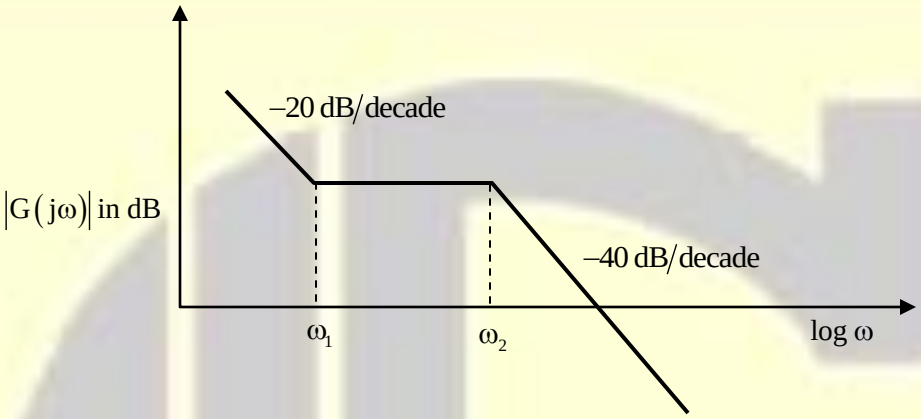


Answer: (0) **Click here to watch video explanation**

56. In an extrinsic semiconductor, the hole concentration is given to be $1.5\,n_i$ where n_i is the intrinsic carrier concentration of $1\times10^{10}\,cm^{-3}$. The ratio of electron to hole mobility for equal hole and electron drift current is given as_____(rounded off to two decimal places).

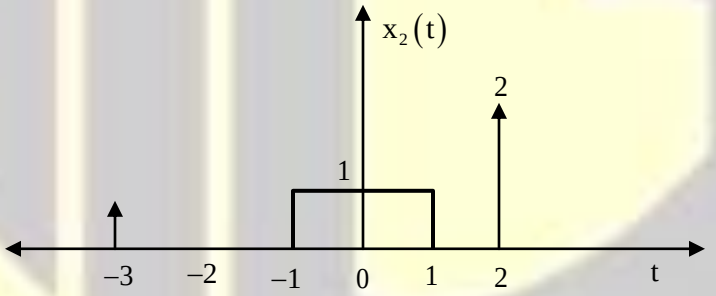
Answer: (2.25) **Click here to watch video explanation**

57. The asymptotic magnitude Bode plot of a minimum phase system is shown in the figure. The transfer function of the system is $G(s)=\frac{k(s+z)^a}{s^b(s+p)^c}$, where k, z, p, a, b and c are positive constants. The value of $(a+b+c)$ is _____ (rounded off to the nearest integer).



Answer: (4) **Click here to watch video explanation**

58. Let $x_1(t)=u(t+1.5)-u(t-1.5)$ and $x_2(t)$ is shown in the figure below. For $y(t)=x_1(t)*x_2(t)$, the $\int_{-\infty}^{\infty}y(t)dt$ is _____ (rounded off to the nearest integer).



Answer: (15) **Click here to watch video explanation**

59. Let X(t) be a white Gaussian noise with power spectral density $\frac{1}{2}$ W/Hz. X(t) is input to an LTI system with impulse response $e^{-t}u(t)$. The average power of the system output is_____W (rounded off to two decimal places).

Answer: (0.25) **Click here to watch video explanation**

60. A transparent dielectric coating is applied to glass $(\varepsilon_r = 4, \mu_r = 1)$ to eliminate the reflection of red light $(\lambda_0 = 0.75\,\mu m)$. The minimum thickness of the dielectric coating, in μm, that can be used is_____(rounded off to two decimal places).

Answer: (0.13) **Click here to watch video explanation**

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61. In a semiconductor device, the Fermi-energy level is 0.35 eV above the valence band energy.The effective density of statesinthevalencebandatT = 300 Kis$1\times10^{19}\,cm^{-3}$. The thermal equilibrium hole concentration in silicon at 400 K is _____ $\times10^{13}\,cm^{-3}$ (rounded off to two decimal places).

Given kT at 300 K is 0.026 eV.

Answer: (63.36) **Click here to watch video explanation**

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62. A sample and hold circuit is implemented using a resistive switch and a capacitor with a time constant of 1 μs. The time for the sampling switch to stay closed to charge a capacitor adequately to a full scale voltage of 1 V with 12-bit accuracy is _____ μs (rounded off to two decimal places).

Answer: (8.37) **Click here to watch video explanation**

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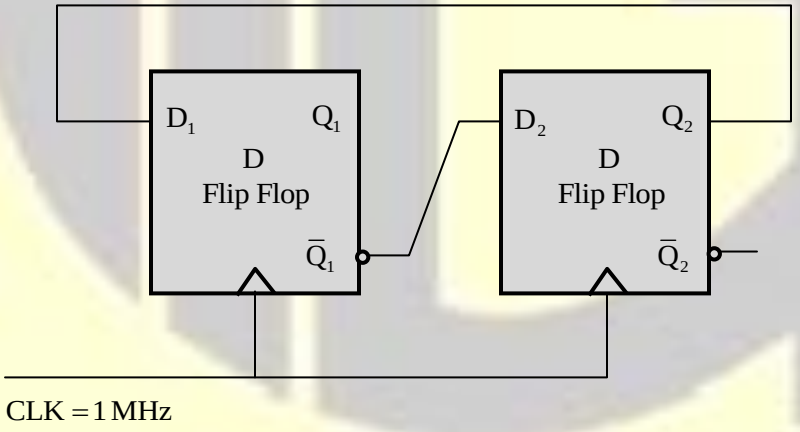
63. In a given sequential circuit, initial states are $Q_1 = 1$ and $Q_2 = 0$. For a clock frequency of 1 MHz, the frequency of signal Q_2 in kHz, is(rounded off to the nearest integer).



Answer: (250) **Click here to watch video explanation**

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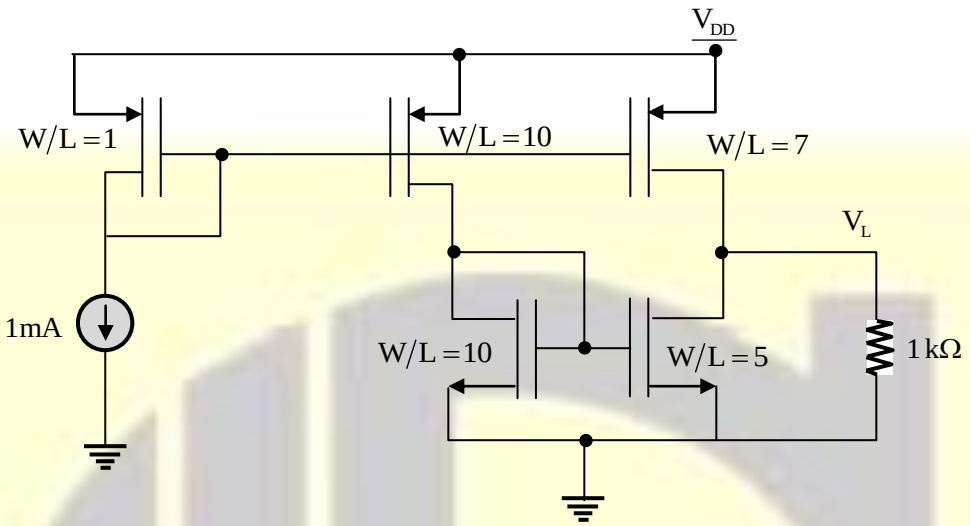
64. In the circuit below, the voltage V_L is _____ V (rounded off to two decimal places).



Answer: (2) **Click here to watch video explanation**

65. The frequency of occurrence of 8 symbols (a-h) is shown in the table below. A symbol is chosen and it is determined by asking a series of "yes/no" questions which are assumed to be truthfully answered. The average number of questions when asked in the most efficient sequence, to determine the chosen symbol, is_____(rounded off to two decimal places).

Symbols	a	b	c	d	e	f	g	h
Frequency of occurrence	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{128}$	$\frac{1}{128}$

Answer: (1.984) **Click here to watch video explanation**