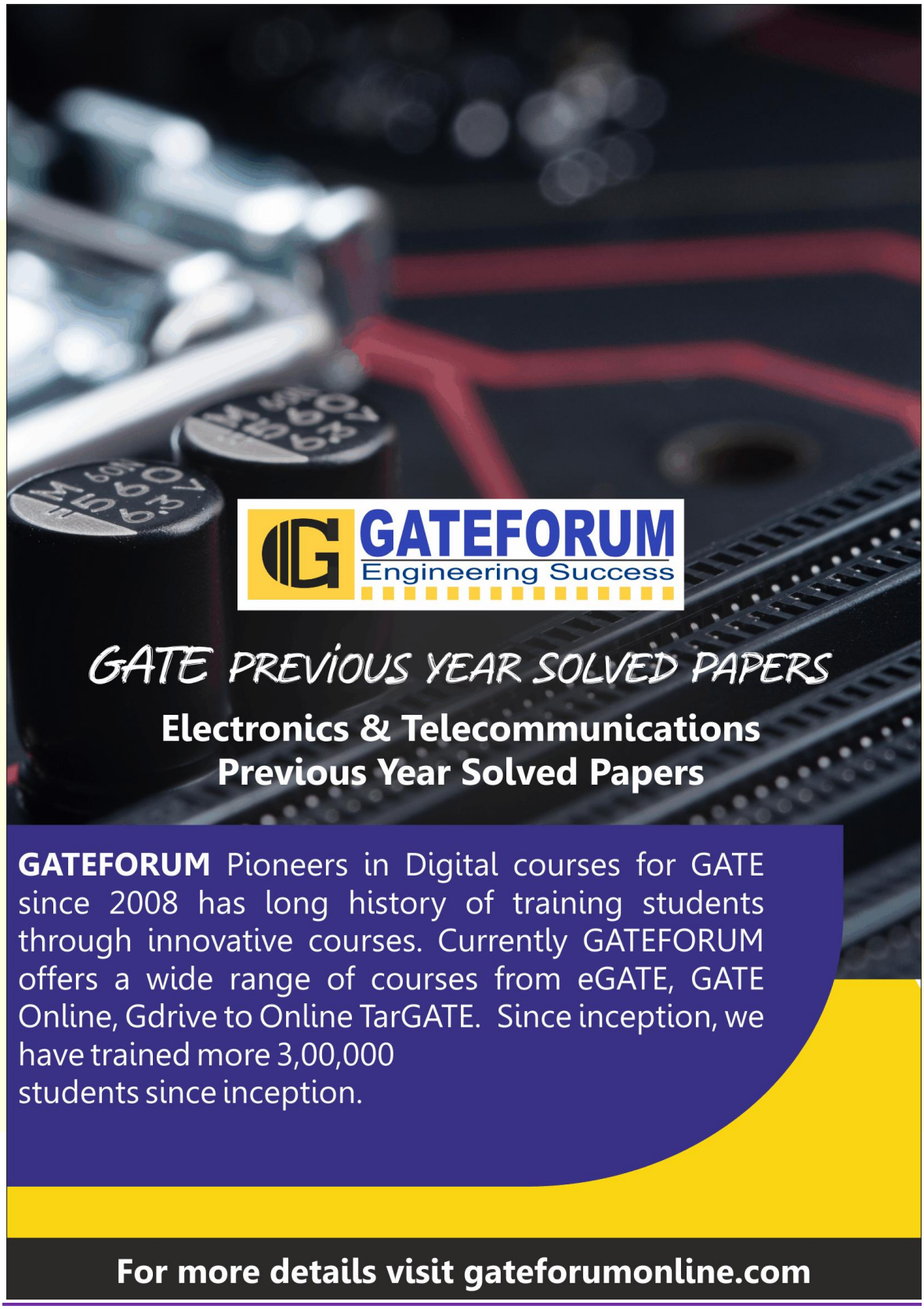


GENERAL APTITUDE

Q. No. 1 – 5 Carry One Mark Each

1. What is the adverb for the given word below?

Misogynous

(A) Misogynousness (B) Misogynity

(C) Misogynously (D) Misogynous

Answer: (C)

---

2. Choose the appropriate word–phrase out of the four options given below, to complete the following sentence

Dhoni, as well as the other team members of Indian team _____ present on the occasion

(A) Were (B) Was (C) Has (D) Have

Answer: (B)

---

3. Ram and Ramesh appeared in an interview for two vacancies in the same department. The probability of Ram's selection is 1/6 and that of Ramesh is 1/8. What is the probability that only one of them will be selected?

(A) 47/48 (B) 1/4 (C) 13/48 (D) 35/48

Answer: (B)

---

4. Choose he word most similar in meaning to the given word:

Awkward

(A) Inept (B) Graceful (C) Suitable (D) Dreadful

Answer: (A)

5. An electric bus has onboard instruments that report the total electricity consumed since the start of the trip as well as the total distance covered. During a single day of operation, the bus travels on stretches M, N, O and P, in that order. The cumulative distances traveled and the corresponding electricity consumption are shown in the Table below:

Stretch	Cumulative distance (km)	Electricity used (kWh)
M	20	12
N	45	25
O	75	45
P	100	57

The stretch where the electricity consumption per km is minimum is

(A) M (B) N (C) O (D) P

Answer: (D)

Q. No. 6 – 10 Carry Two Marks Each

6. Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

Statements:

All film stars are playback singers.

All film directors are film stars

Conclusions:

I. All film directors are playback singers.

II. Some film stars are film directors.

(A) Only conclusion I follows (B) Only conclusion II follows

(C) Neither conclusion I nor II follows (D) Both conclusions I and II follow

Answer: (D)

7. Lamenting the gradual sidelining of the arts ill school curricula, a group of prominent artists wrote to the Chief Minister last year, asking him to allocate more funds to support arts education in schools. However, no such increase has been announced in this year's Budget. The artists expressed their deep anguish at their request not being approved, but many of them remain optimistic about funding in the future

Which of the statement(s) below is/are logically valid and can be inferred from the above statements?

(i) The artists expected funding for the arts to increase this year

(ii) The Chief Minister was receptive to the idea of increasing funding for the arts

(iii) The Chief Minister is a prominent artist

(iv) Schools are giving less importance to arts education nowadays

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

Answer: (B)

---

8. A tiger is 50 leaps of its own behind a deer. The tiger takes 5 leaps per minute to the deer's 4. If the tiger and the deer cover 8 metre and 5 metre per leap respectively. What distance in metres will be tiger have to run before it catches the deer?

Answer: (800)

---

9. If $a^2 + b^2 + c^2 = 1$, then $ab + bc + ac$ lies in the interval

(A) [1, 2/3] (B) [–1/2, 1] (C) [–1, 1/2] (D) [2, –4]

Answer: (B)

---

10. In the following sentence certain parts are underlined and marked P, Q and R. One of the parts may contain certain error or may not be acceptable in standard written communication. Select the part containing an error. Choose D as your answer if there is no error.

The student corrected <u>all the errors</u> that <u>the instructor marked</u> on the <u>answer book</u>

P Q R

(A) P (B) Q (C) R (D) No error

Answer: (B)

ELECTRONICS AND COMMUNICATION ENGINEERING

Q. No. 1 – 25 Carry One Mark Each

1. Let the signal $f(t)=0$ outside the interval $[T_1,\ T_2]$, where T_1 and T_2 are finite. Furthermore, $|f(t)|<\infty$. The region of convergence (ROC) of the signal's bilateral Laplace transform F(s) is

(A) a parallel strip containing the $j\Omega$ axis

(B) a parallel strip not containing the $j\Omega$ axis

(C) the entire s-plane

(D) a half plane containing the $j\Omega$ axis

Answer: (C)

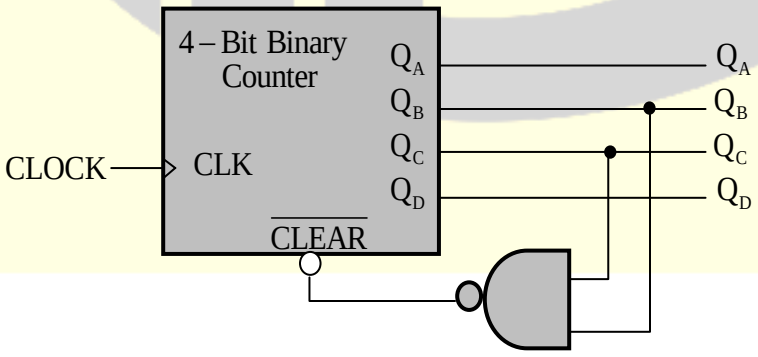
---

2. A unity negative feedback system has an open–loop transfer function $G(s)=\dfrac{k}{s(s+10)}$. The gain k for the system to have a damping ratio of 0.25 is _____.

Answer: (400)

---

3. A mod–n counter using a synchronous binary up–counter with synchronous clear input is shown in the figure. The value of n is _____



Answer: (7)

4. By performing cascading and/or summing / differencing operations using transfer function blocks $G_1(s)$ and $G_2(s)$, one cannot realize a transfer function of the form

(A) $G_1(s)G_2(s)$ (B) $\dfrac{G_1(s)}{G_2(s)}$

(C) $G_1(s)\left(\dfrac{1}{G_1(s)}+G_2(s)\right)$ (D) $G_1(s)\left(\dfrac{1}{G_1(s)}-G_2(s)\right)$

Answer: (B)

5. The electric field of a uniform plane electromagnetic wave is

$$\vec{E}=\left(\vec{a}_x+j4\vec{a}_y\right)\exp\left[j\left(2\pi\times10^7 t-0.2z\right)\right]$$

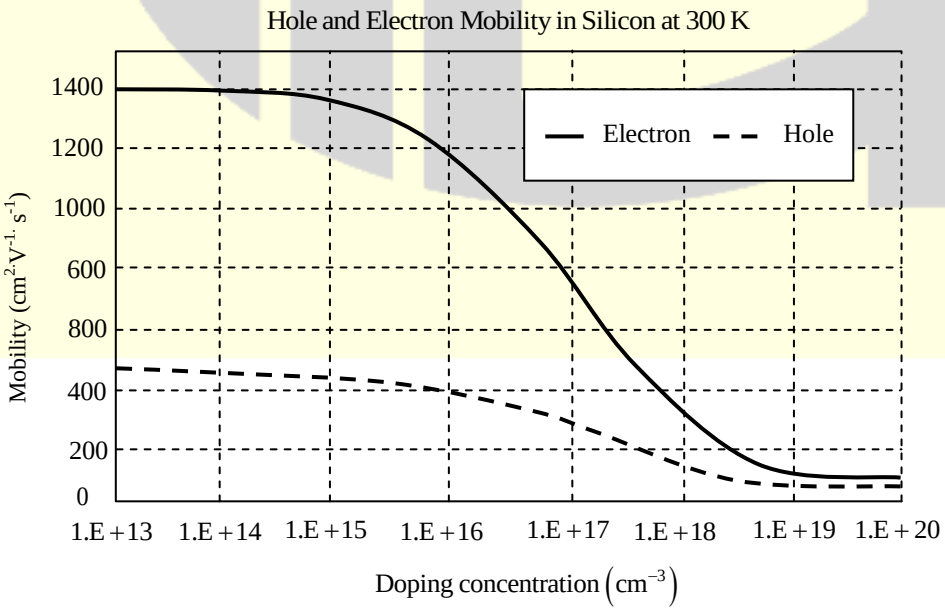
The polarization of the wave is

(A) Righthanded circular (B) Right handed elliptical

(C) Left handed circular (D) Left handed elliptical

Answer: (D)

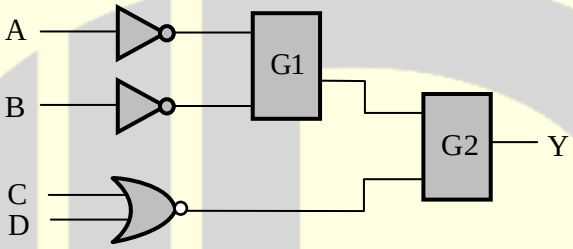
6. A piece of silicon is doped uniformly with phosphorous with a doping concentration of 10^{16} / cm^3.



The expected value of mobility versus doping concentration for silicon assuming full dopant ionization is shown below. The charge of an electron is 1.6×10^{-19} C. The conductivity $\left(\text{in S cm}^{-1}\right)$ of the silicon sample at 300 K is _____.

Answer: (1.92)

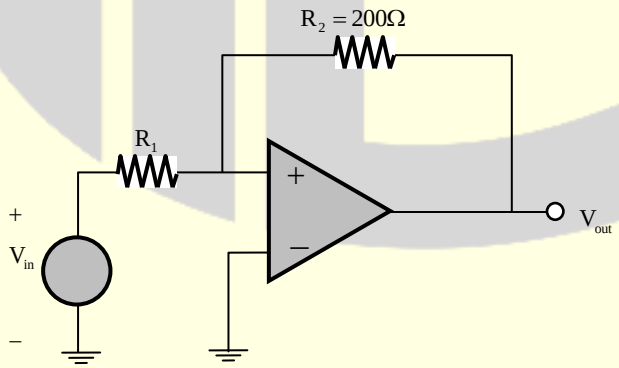
7. In the figure shown, the output Y is required to be $Y = AB + \bar{C}\bar{D}$. The gates G1 and G2 must be, respectively,



(A) NOR, OR (B) OR, NAND (C) NAND, OR (D) AND, NAND

Answer: (A)

8. In the bistable circuit shown, the ideal opamp has saturation level of ±5.



The value of $R_1\left(\text{in k}\Omega\right)$ that gives a hysteresis width of 500 mV is _____.

Answer: (1)

9. Two causal discrete–time signal $x[n]$ and $y[n]$ are related as $y[n]=\sum_{m=0}^{n} x[m]$

It the z–transform of $y[n]$ is $\frac{2}{z(z-1)^2}$, the value of $x[2]$ is _____

Answer: (0)

---

10. The bilateral Laplace transform of a function $f(t)=\begin{cases}1 & \text{if } a \le t \le b\\ 0 & \text{otherwise}\end{cases}$ is

(A) $\frac{a-b}{s}$

(B) $\frac{e^{s}(a-b)}{s}$

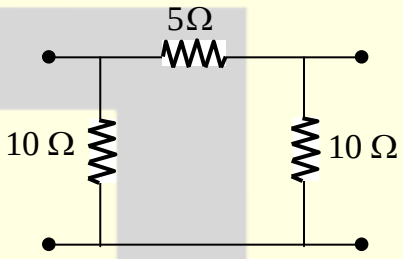
(C) $\frac{e^{-as}-e^{-bs}}{s}$

(D) $\frac{e^{-(a-b)}}{s}$

Answer: (C)

---

11. The 2–port admittance matrix of the circuit shown is given by



(A) $\begin{bmatrix}0.3 & 0.2\\ 0.2 & 0.3\end{bmatrix}$

(B) $\begin{bmatrix}15 & 5\\ 5 & 15\end{bmatrix}$

(C) $\begin{bmatrix}3.33 & 5\\ 5 & 3.33\end{bmatrix}$

(D) $\begin{bmatrix}0.3 & 0.4\\ 0.4 & 0.3\end{bmatrix}$

Answer: (A)

---

12. The value of *x* for which all the eigen–values of the matrix given below are real is

$$\begin{bmatrix}10 & 5+j & 4\\ x & 20 & 2\\ 4 & 2 & -10\end{bmatrix}$$

(A) 5 + j (B) 5 – j (C) 1 – 5j (D) 1+ 5 j

Answer: (B)

13. The signal $\cos\left(10\pi t+\frac{\pi}{4}\right)$ is ideally sampled at a sampling frequency of 15Hz. The sampled signal is passed through a filter with impulse response $\left(\frac{\sin(\pi t)}{\pi t}\right)\cos\left(40\pi t-\frac{\pi}{2}\right)$. The filter output is

(A) $\frac{15}{2}\cos\left(40\pi t-\frac{\pi}{4}\right)$

(B) $\frac{15}{2}\left(\frac{\sin(\pi t)}{\pi t}\right)\cos\left(10\pi t+\frac{\pi}{4}\right)$

(C) $\frac{15}{2}\cos\left(10\pi t-\frac{\pi}{4}\right)$

(D) $\frac{15}{2}\left(\frac{\sin(\pi t)}{\pi t}\right)\cos\left(40\pi t-\frac{\pi}{2}\right)$

Answer: (A)

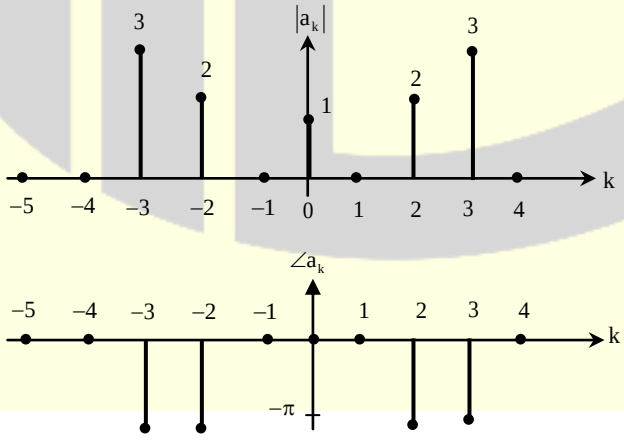
---

14. A sinusoidal signal of amplitude Ais quantized by a uniform quantizer Assume that the signal utilizes all the representation levels of the quantizer. If the signal to quantization noise ratio is 31.8 dB, the number of levels in the quantizer is _____.

Answer: (32)

---

15. The magnitude and phase of the complex Fourier series coefficient a_k of a periodic signal x(t) are shown in the figure.



Choose the correct statement from the four choices given. Notation: C is the set of complex numbers, R is the set of real numbers and P is the set of purely imaginary numbers.

(A) $x(t) \in R$

(B) $x(t) \in P$

(C) $x(t) \in (C - R)$

(D) The information given is not sufficient to draw any conclusion about x(t)

Answer: (A)

---

16. The general solution of the differential equation $\frac{dy}{dx} = \frac{1+\cos 2y}{1-\cos 2x}$ is

(A) $\tan y - \cot x = c$ (c is a constant)

(B) $\tan x - \cot y = c$ (c is a constant)

(C) $\tan y + \cot x = c$ (c is a constant)

(D) $\tan x + \coty = c$ (c is a constant)

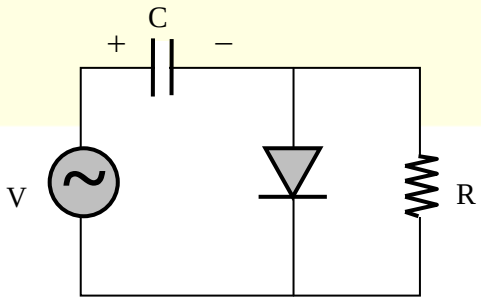
Answer: (C)

---

17. An n–type silicon sample is uniformly illuminated with light which generates 10^{20} electron hole pairs per cm^3 per second. The minority carrier lifetime in the sample is $1\mu s$. In the steady state, the hole concentration in the sample is approximately 10^x, where x is an integer. The value of x is _____.

Answer: (14)

18. If the circuit shown has to function as a clamping circuit, which one of the following conditions should be satisfied for sinusoidal signal of period T?



(A) RC<<T (B) RC = 0.35T

(C) $RC \approx T$ (D) RC >> T

Answer: (D)

19. In a source free region in vacuum, if the electrostatic potential $\varphi = 2x^2 + y^2 + cz^2$, the value of constant c must be _____.

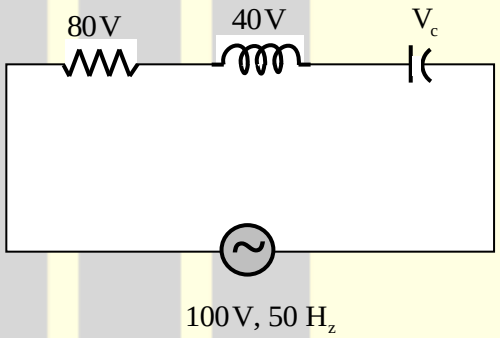
Answer: (–3)

20. In an 8085 microprocessor, which one of the following instructions changes the content of the accumulator?

(A) MOV B, M (B) PCHL (C) RNZ (D) SBI BEH

Answer: (D)

21. The voltage (V_C) across the capacitor (in Volts) in the network shown is _____



Answer: (100)

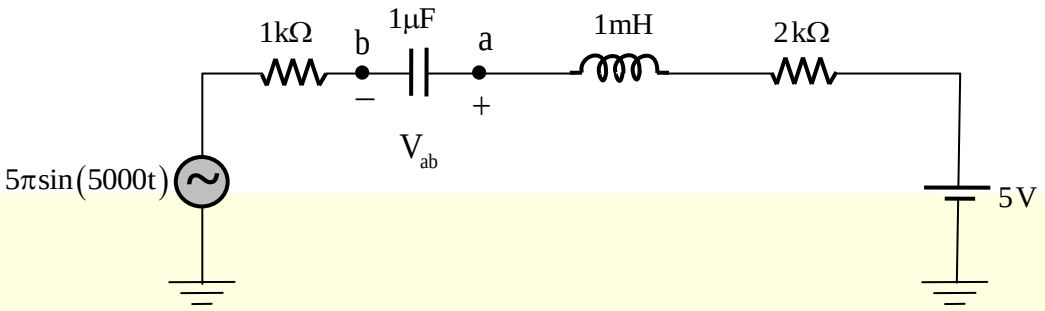
22. Let $f(z) = \frac{az+b}{cz+d}$. If $f(z_1) = f(z_2)$ for all

$z_1 \neq z_2, a = 2, b = 4$ and $c = 5$,

then d should be equal to _____.

Answer: (10)

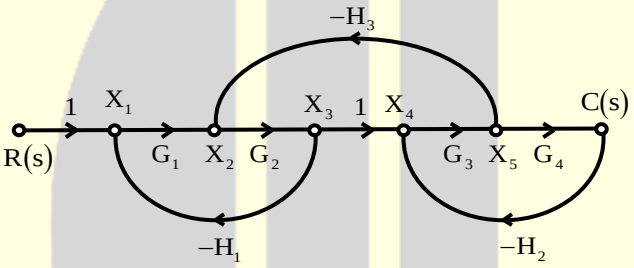
23. In the circuit shown the average value of the voltage V_{ab} (in Volts) in steady state condition is _____.



Answer: (5)

---

24. For the signal flow graph shown in the figure, the value of $\frac{C(s)}{R(s)}$ is



(A) $\dfrac{G_1G_2G_3G_4}{1-G_1G_2H_1-G_3G_4H_2-G_2G_3H_3+G_1G_2G_3G_4H_1H_2}$

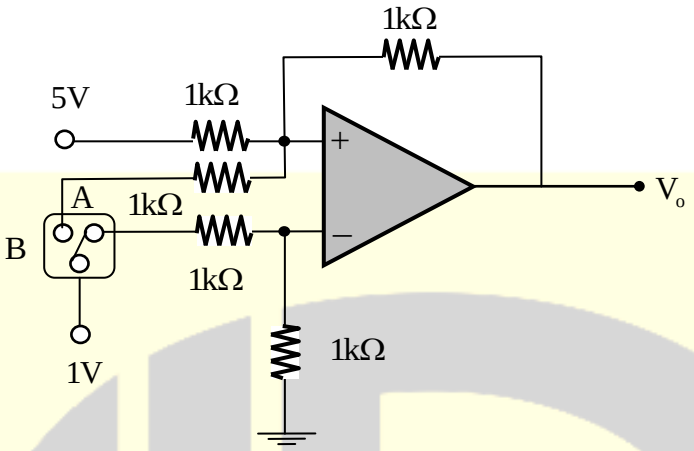
(B) $\dfrac{G_1G_2G_3G_4}{1+G_1G_2H_1+G_3G_4H_2+G_2G_3H_3+G_1G_2G_3G_4H_1H_2}$

(C) $\dfrac{1}{1+G_1G_2H_1+G_3G_4H_2+G_2G_3H_3+G_1G_2G_3G_4H_1H_2}$

(D) $\dfrac{1}{1-G_1G_2H_1-G_3G_4H_2-G_2G_3H_3+G_1G_2G_3G_4H_1H_2}$

Answer: (B)

25. In the circuit shown, $V_0=V_{0A}$ for switch SW in position A and $V_0=V_{0B}$ for SW in position B. Assume that the opamp is ideal.



The value of $\frac{V_{0B}}{V_{0A}}$ is _____.

Answer: (1.5)

Q. No. 26 – 55 carry Two Marks Each

26. Let $X \in \{0,1\}$ and $Y \in \{0,1\}$ be two independent binary random variables. If P (X = 0) = p and P(Y = 0) = q, then $P(X+Y \geq 1)$ is equal to

(A) $pq+(1-p)(1-q)$ (B) pq

(C) $p(1-q)$ (D) $1-pq$

Answer: (D)

---

27. An LC tank circuit consists of an ideal capacitor C connected in parallel with a coil of inductance L having an internal resistance R. The resonant frequency of the tank circuit is

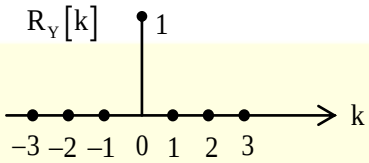
(A) $\frac{1}{2\pi\sqrt{LC}}$ (B) $\frac{1}{2\pi\sqrt{LC}}\sqrt{1-R^2\frac{C}{L}}$

(C) $\frac{1}{2\pi\sqrt{LC}}\sqrt{1-\frac{L}{R^2C}}$ (D) $\frac{1}{2\pi\sqrt{LC}}\left(1-R^2\frac{C}{L}\right)$

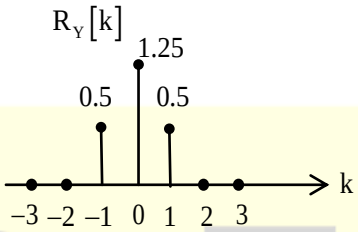
Answer: (B)

28. $\{X_n\}_{n=-\infty}^{n=\infty}$ is an independent and identically distributed (iid,) random process with X_n equally likely to be $+1$ or -1. $\{Y_n\}_{n=-\infty}^{n=\infty}$ is another random process obtained as $Y_n = X_n + 0.5X_{n-1}$. The autocorrelation function of $\{Y_n\}_{n=-\infty}^{n=\infty}$ denoted by $R_Y[k]$ is

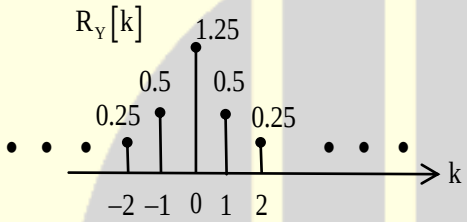
(A)



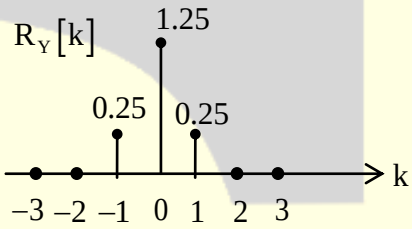
(B)



(C)



(D)



Answer: (B)

---

29. In a MOS capacitor with an oxide layer thickness of 10 nm, the maximum depletion layer thickness is 100 nm. The permittivities of the semiconductor and the oxide layer are ε_s and ε_{ox} respectively. Assuming $\varepsilon_s / \varepsilon_{ox} = 3$, the ratio of the maximum capacitance to the minimum capacitance of this MOS capacitor is _____.

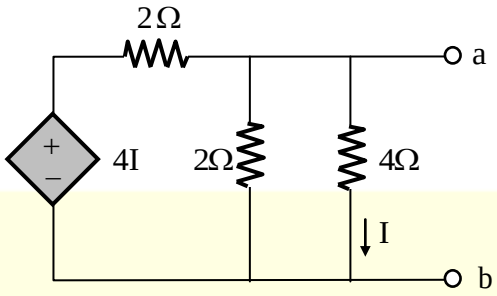
Answer: (4.33)

---

30. Let the random variable *X* represent the number of times a fair coin needs to be tossed till two consecutive heads appear for the first time. The expectation of *X* is _____.

Answer: (1.5)

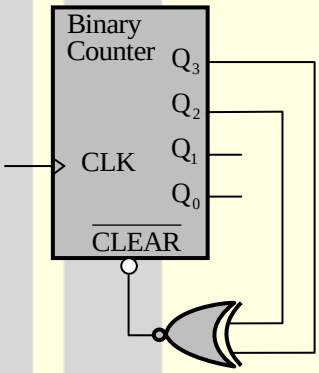
31. In the circuit shown, the Norton equivalent resistance $(\text{in}\,\Omega)$ across terminals a–b is _____.



Answer: (1.333)

---

32. The figure shows a binary counter with synchronous clear input. With the decoding logic shown, the counter works as a



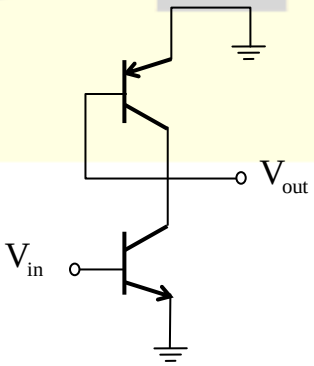
(A) mod–2 counter (B) mod–4 counter (C) mod–5 counter (D) mod–6 counter

Answer: (C)

---

33. In the ac equivalent circuit shown, the two BJTs are biased in active region and have identical parameters with $\beta >> 1$.

The open circuit small signal voltage gain is approximately _____.



Answer: (–1)

34. The state variable representation of a system is given as

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix} x; \quad x(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$
$$y = \begin{bmatrix} 0 & 1 \end{bmatrix} x$$

The response y(t) is

(A) sin(t) (B) $1 - e^{t}$ (C) $1 - \cos(t)$ (D) 0

Answer: (D)

---

35. Consider the differential equation

$\frac{dx}{dt} = 10 - 0.2x$ with initial condition $x(0) = 1$. The response $x(t)$ for $t > 0$ is

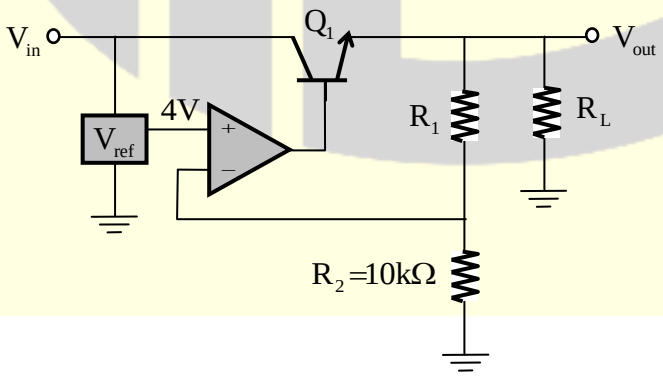
(A) $2 - e^{-0.2t}$ (B) $2 - e^{0.2t}$

(C) $50 - 49e^{-0.2t}$ (D) $50 - 49e^{0.2t}$

Answer: (C)

---

36. For the voltage regulator circuit shown, the input voltage (V_{in}) is $20V \pm 20\%$ and the regulated output volage (V_{out}) is 10V. Assume the opamp to be ideal.



For a load R_L drawing 200 mA, the maximum power dissipation in Q_1 (in Watts) is _____.

Answer: (2.8056)

37. Input x(t) and output y(t) of an LTI system are related by the differential equation $y''(t)-y'(t)-6y(t)=x(t)$. If the system neither causal nor stable, the impulse response h(t) of the system is

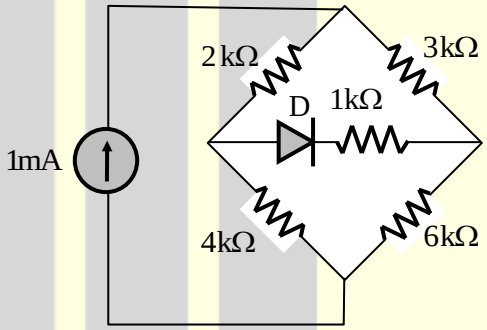
(A) $\frac{1}{5}e^{3t}u(-t)+\frac{1}{5}e^{-2t}u(-t)$ (B) $-\frac{1}{5}e^{3t}u(-t)+\frac{1}{5}e^{-2t}u(-t)$

(C) $\frac{1}{5}e^{3t}u(-t)-\frac{1}{5}e^{-2t}u(t)$ (D) $-\frac{1}{5}e^{3t}u(-t)-\frac{1}{5}e^{-2t}u(t)$

Answer: (B)

---

38. The diode in the circuit given below has $V_{ON}=0.7V$ but is ideal otherwise. The current (in mA) in the $4k\Omega$ resistor is _____.



Answer: (0.6)

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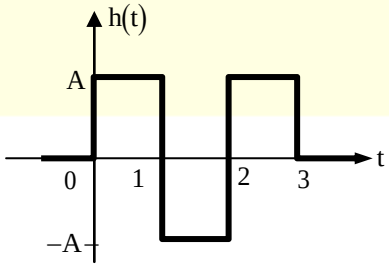
39. A zero mean white Gaussian noise having power spectral density $\frac{N_0}{2}$ is passed through an LTI filter whose impulse response h(t) is shown in the figure.



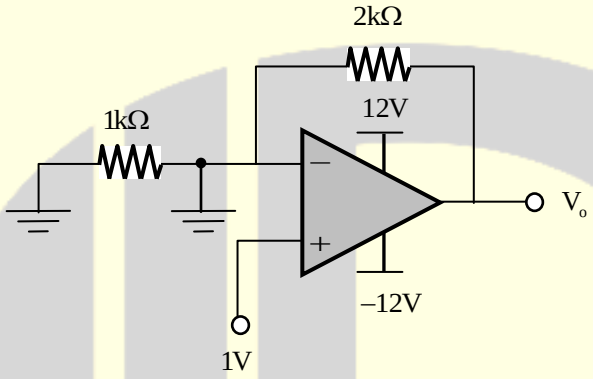
The variance of the filtered noise at t = 4 is

(A) $\frac{3}{2}A^2N_0$ (B) $\frac{3}{4}A^2N_0$ (C) A^2N_0 (D) $\frac{1}{2}A^2N_0$

Answer: (A)

---

40. Assuming that the op-amp in the circuit shown below is ideal, the output voltage V_0 (in volts) is _____.



Answer: (12)

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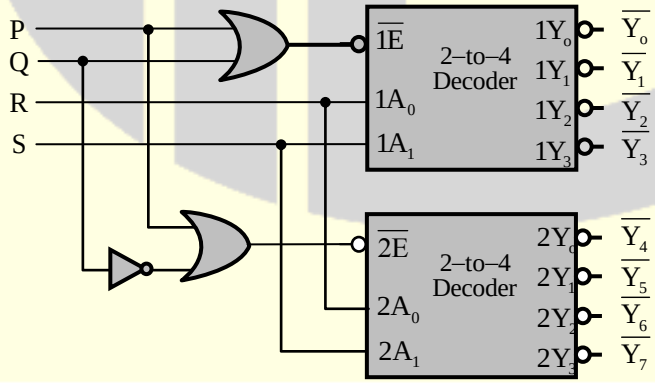
41. A 1–to–8 demultiplexer with data input D_{in}, address inputs S_0, S_1, S_2 (with S_0 as the LSB) and $\overline{Y}_0$ to $\overline{Y}_7$ as the eight demultiplexed output, is to be designed using two 2–to–4 decoders (with enable input $\overline{E}$ and address input A_0 and A_1) as shown in the figure.



D_{in}, S_0, S_1 and S_2 are to be connected to P, Q, R and S, but not necessarily in this order. The respective input connections to P, Q, R and S terminals should be

(A) S_2, D_{in}, S_0, S_1 (B) S_1, D_{in}, S_0, S_2 (C) D_{in}, S_0, S_1, S_2 (D) D_{in}, S_2, S_0, S_1

Answer: (D)

42. The value of the integral $\int_{-\infty}^{\infty} 12\cos(2\pi t)\,\frac{\sin(4\pi t)}{4\pi t}\,dt$ is _____.

Answer: (3)

---

43. A function of Boolean variables X, Y and Z is expressed in terms of the min–terms as $F(X,Y,Z)=\Sigma(1,2,5,6,7)$

Which one of the product of sums given below is equal to the function $F(X,Y,Z)$?

(A) $(\bar{X}+\bar{Y}+\bar{Z}).(\bar{X}+Y+Z).(X+\bar{Y}+\bar{Z})$

(B) $(X+Y+Z).(X+\bar{Y}+\bar{Z}).(\bar{X}+Y+Z)$

(C) $(\bar{X}+\bar{Y}+Z).(\bar{X}+Y+\bar{Z}).(X+\bar{Y}+Z).(X+Y+\bar{Z}).(X+Y+Z)$

(D) $(X+Y+\bar{Z}).(\bar{X}+Y+Z).(\bar{X}+Y+\bar{Z}).(\bar{X}+\bar{Y}+Z).(\bar{X}+\bar{Y}+\bar{Z})$

Answer: (B)

---

44. The transfer function of a mass–spring damper system is given by $G(s)=\frac{1}{Ms^2+Bs+k}$

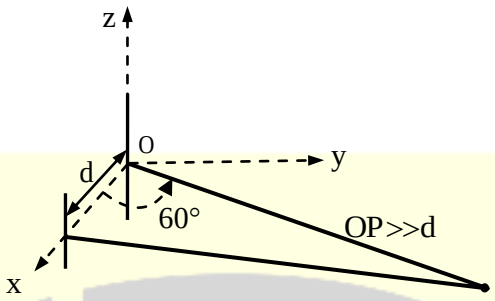
The frequency response data for the system are given in the following table.

ω in rad/s	$\lvert G(j\omega)\rvert$ in dB	$\arg(G(j\omega))$ in deg
0.01	–18.5	–0.2
0.1	–18.5	–1.3
0.2	–18.4	–2.6
1	–16	–16.9
2	–11.4	–89.4
3	–21.5	–151
5	–32.8	–167
10	–45.3	–174.5

The unit step response of the system approaches a steady state value of _____.

Answer: (0.12)

45. Two half–wave dipole antennas placed as shown in the figure are excited with sinusoidally varying currents of frequency 3 MHz and phase shift of $\pi/2$ between them (the element at the origin leads in phase).



If the maximum radiated E–field at the point P in the x–y plane occurs at an azimuthal angle of $60^{o.}$ the distance d (in meters) between the antennas is _____.

Answer: (50)

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46. An air–filled rectangular waveguide of internal dimensions a $cm \times bcm (a > b)$ has a cutoff frequency of 6 GHz for the dominant TE_{10} mode. For the same waveguide, if the cutoff frequency of the TM_{11} mode is 15 GHz, the cutoff frequency of the TE_{01} mode in GHz is _____.

Answer: (13.74)

---

47. Consider two real sequences with time-origin marked by the bold value,

$x_1[n] = \{1, 2, 3, 0\}, x_2[n] = \{1, 3, 2, 1\}$

Let $X_1(k)$ and $X_2(k)$ be 4-point DFTs of $x_1[n]$ and $x_2[n]$, respectively.

Another sequence $x_3[n]$ is derived by taking 4-point inverse DFT of $X_3(k) = X_1(k)X_2(k)$. The value of $x_3[2]$ is _____.

Answer: (11)

48. Let $x(t)=\alpha s(t)+s(-t)$ with $s(t)=\beta e^{-4t}u(t)$, where u(t) is unit step function. If the bilateral Laplace transform of x(t) is $X(s)=\dfrac{16}{s^2-16}\ -4<\mathrm{Re}\{s\}<4;$

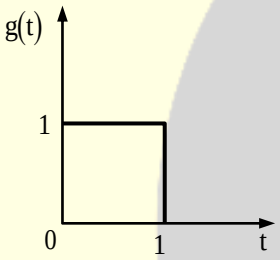
then the value of β is _____.

Answer: (–2)

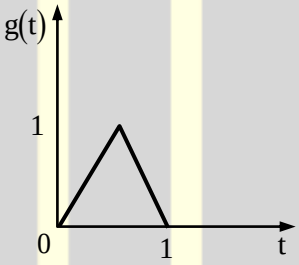
---

49. Consider a binary, digital communication system which used pulses $g(t)$ and $-g(t)$ for transmitting bits over an AWGN channel. If the receiver uses a matched filter, which one of the following pulses will give the minimum probability of bit error?

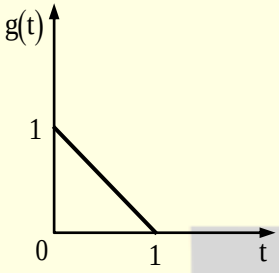
(A)



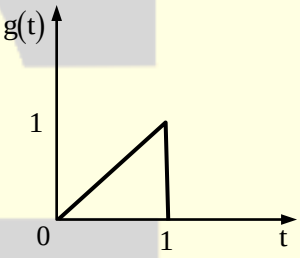
(B)



(C)



(D)



Answer: (A)

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50. The electric field of a plane wave propagating ina lossless non-magnetic medium is given by the following expression

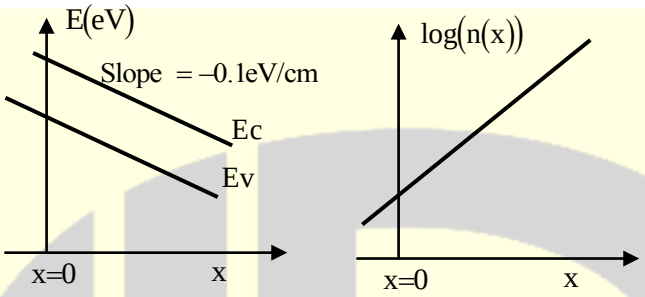
$$E(z,t)=\hat{a}_x 5\cos\left(2\pi\times10^9 t+\beta z\right)+\hat{a}_y 3\cos\left(2\pi\times10^9+\beta z\right)-\frac{\pi}{2}$$

The type of the polarization is

(A) Right Hand Circular.
(B) Left Hand Elliptical
(C) Right Hand Elliptical
(D) Linear

Answer: (B)

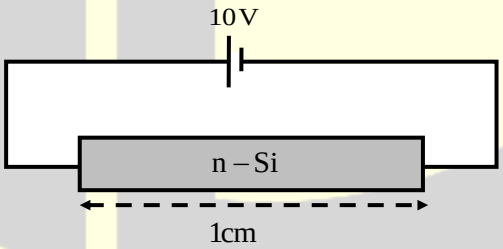
51. The energy band diagram and electron density profile n(x) in a semiconductor are shown in the figure. Assume that $n(x) = 10^{15} e^{\left(\frac{q\alpha x}{kT}\right)} cm^{-3}$ with $\alpha = 0.1 V/cm$ and x expressed in cm. Given $\frac{kT}{q} = 0.026V$, $D_n = 36 cm^2 s^{-1}$, and $\frac{D}{\mu} = \frac{kT}{q}$ the electron current density $\left(\text{in } A/cm^2\right)$ at x = 0 is_____.



(A) -4.4×10^{-2} (B) -2.2×10^{-2} (C) 0 (D) 2.2×10^{-2}

Answer: (C)

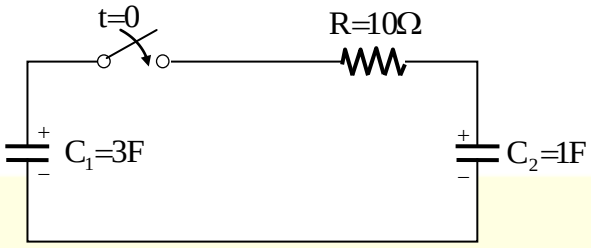
52. A dc voltage of 10V is applied across an n-type silicon bar having a rectangular cross-section and a length of 1cm as shown in figure.



The donor doping concentration N_D and the mobility of electrons μ_n are $10^{16} cm^{-3}$ and $1000 cm^2 V^{-1} s^{-1}$, respectively the average time $(\text{in } \mu s)$ taken by the electrons to move from one end of the bar to other end is _____.

Answer: (100)

53. In the circuit shown, the initial voltages across the capacitors C_1 and C_2 are 1V and 3V, respectively.



The switch is closed at time t = 0. The total energy dissipated (in Joules) in the resistor R until steady state is reached is _____.

Answer: (1.5)

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54. The output of a standard second–order system for a unit step input is given as $y(t)=1-\frac{2}{\sqrt{3}}e^{-t}\cos\left(\sqrt{3}t-\frac{\pi}{6}\right)$. The transfer function of the system is

(A) $\frac{2}{(s+2)(s+\sqrt{3})}$ (B) $\frac{1}{s^2+2s+1}$ (C) $\frac{3}{s^2+2s+3}$ (D) $\frac{4}{s^2+2s+4}$

Answer: (D)

---

55. If C denotes the counter-clockwise unit circle, the value of the contour integral $\frac{1}{2\pi j}\oint_C \mathrm{Re}\{z\}\,dz$ is _____.

Answer: (0.5)