Q.1 – Q.5 carry two marks each.

Q.1. Which of the following is CORRECT with respect to grammar and usage? Mount Everest is __________.

[GATE EC 2016]

A. the highest peak in the world
B. highest peak in the world
C. one of highest peak in the world
D. one of the highest peak in the world

Q.2. The policeman asked the victim of a theft, "What did you ________?"

[GATE EC 2016]

A. loose
B. lose
C. loss
D. lost

Q.3. Despite being warned repeatedly by friends and family about his deteriorating health, his smoking habit remained ________.

[GATE EC 2016]

A. incorrigible
B. invincible
C. inevitable
D. inexorable

Q.4. A rewording of something written or spoken is a ________.

[GATE EC 2016]

A. paraphrase
B. paradox
C. paradigm
D. paraffin

Q.5. In a 500 m race, the ratio of the speeds of two contestants A and B is 3:4. A has a start of 140 m. Then, A wins by ________.

[GATE EC 2016]

A. 10 m B. 20 m C. 30 m D. 40 m

Q.6 – Q.10 carry two marks each.

Q.6. A person travelled 80 km in 6 hours. If a part of the journey was travelled at 10 km/h and the remaining at 18 km/h, the distance travelled at 10 km/h was ________.

[GATE EC 2016]

A. 30 km B. 40 km C. 50 km D. 60 km

Q.7. A transporter receives the same number of orders each day. The transport cost is \$10 for the first order of the day and \$8 for each subsequent order. If the total cost per day is \$98, the number of orders received each day is ________.

[GATE EC 2016]

A. 11 B. 12 C. 13 D. 14

Q.8. A container originally contains 10 litres of pure spirit. From this container, 1 litre of spirit is replaced with 1 litre of water. Subsequently, 1 litre of the mixture is replaced with 1 litre of water and this process is repeated one more time. The ratio of spirit to water in the resulting mixture is ________.

[GATE EC 2016]

A. 729:271 B. 81:19 C. 64:27 D. 343:27

Q.9. P, Q, R, S, T, U, V and W are seated around a circular table. R is between V and T; R is opposite P; W is between T and U; P and S are not on either side of U. Who is opposite Q?

[GATE EC 2016]

A. R B. S C. T D. U

Q.10. The data given in the following table summarizes the monthly budget of an average household.

Category	Expenditure (in %)
Food	35
Housing	15
Clothing	10
Transportation	20
Savings	10
Other	10

Which two categories have identical expenditure?

[GATE EC 2016]

A. Food and Housing

B. Housing and Savings

C. Clothing and Savings

D. Transportation and Other

Q.1 – Q.25 carry one mark each.

Q.1. Let $M^4 = I$ (where I denotes the identity matrix) and $M \neq I,\ M^2 \neq I,\ M^3 \neq I$. Then, for any natural number k, M^{-1} equals:
[GATE EC 2016]

a. M^{4k+1}
b. M^{4k+2}
c. M^{4k+3}
d. M^{4k}

Q.2. The second moment of a Poisson-distributed random variable is 2. The mean of the random variable is ____________.
[GATE EC 2016]

Q.3. Given the following statements about a function $f : \mathbb{R} \to \mathbb{R}$, select the right option:

P: If $f(x)$ is continuous at $x = x_0$, then it is also differentiable at $x = x_0$.
Q: If $f(x)$ is continuous at $x = x_0$, then it may not be differentiable at $x = x_0$.
R: If $f(x)$ is differentiable at $x = x_0$, then it is also continuous at $x = x_0$.

[GATE EC 2016]

a. P is true, Q is false, R is false
b. P is false, Q is true, R is true
c. P is false, Q is true, R is false
d. P is true, Q is false, R is true

Q.4. Which one of the following is a property of the solutions to the Laplace equation $\nabla^2 f = 0$?
[GATE EC 2016]

a. The solutions have neither maxima nor minima anywhere except at the boundaries.
b. The solutions are not separable in the coordinates.
c. The solutions are not continuous.
d. The solutions are not dependent on the boundary conditions.

Q.5. Consider the plot of $f(x)$ versus x as shown below.

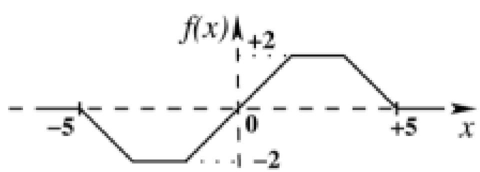

Figure 1: Plot of $f(x)$.

Suppose $F(x) = \int_{-5}^{x} f(y)\, dy$. Which one of the following is a graph of $F(x)$?

[GATE EC 2016]

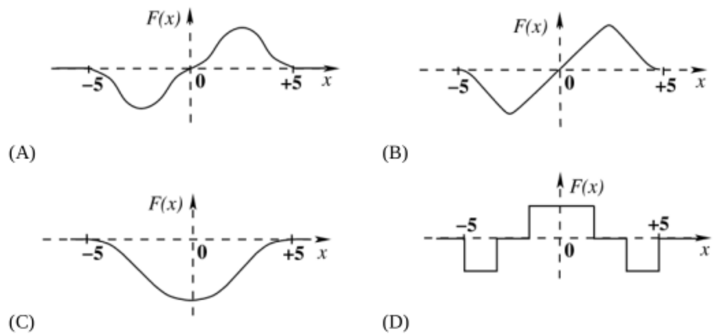

Figure 2: options

Q.6. Which one of the following is an eigenfunction of the class of all continuous-time, linear, time-invariant systems ($u(t)$ denotes the unit-step function)?
[GATE EC 2016]

a. $e^{j\omega_0 t}u(t)$
b. $\cos(\omega_0 t)$
c. $e^{j\omega_0 t}$
d. $\sin(\omega_0 t)$

Q.7. A continuous-time function $x(t)$ is periodic with period T. The function is sampled uniformly with sampling period T_s. In which one of the following cases is the sampled signal periodic?
[GATE EC 2016]

a. $T = \sqrt{2}\,T_s$
b. $T = 1.2\,T_s$
c. Always
d. Never

Q.8. Consider the sequence $x[n] = a^n u[n] + b^n u[n]$, where $u[n]$ denotes the unit-step sequence and $0 < |a| < |b| < 1$. The region of convergence (ROC) of the Z-transform of $x[n]$ is
[GATE EC 2016]

a. $|z| > |a|$
b. $|z| > |b|$
c. $|z| < |a|$
d. $|a| < |z| < |b|$

Q.9. Consider a two-port network with the transmission matrix $T = \begin{pmatrix} A & B \\ C & D \end{pmatrix}$. If the network is reciprocal, then
[GATE EC 2016]

a. $T^{-1} = T$

b. $T^2 = T$

c. $\det(T) = 0$

d. $\det(T) = 1$

Q.10. A continuous-time sinusoid of frequency 33 Hz is multiplied with a periodic Dirac impulse train of frequency 46 Hz. The resulting signal is passed through an ideal analog low-pass filter with cutoff frequency 23 Hz. The fundamental frequency (in Hz) of the output is ______________.

[GATE EC 2016]

Q.11. A small percentage of impurity is added to an intrinsic semiconductor at 300 K. Which one of the following statements is true for the energy band diagram shown in the figure?

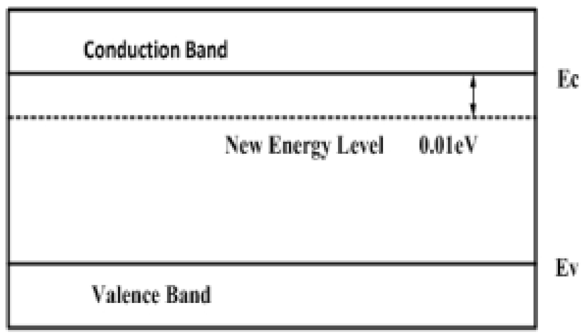

Figure 3: Energy band diagram (Q.11)

[GATE EC 2016]

a. Intrinsic semiconductor doped with pentavalent atoms to form n-type semiconductor

b. Intrinsic semiconductor doped with trivalent atoms to form n-type semiconductor

c. Intrinsic semiconductor doped with pentavalent atoms to form p-type semiconductor

d. Intrinsic semiconductor doped with trivalent atoms to form p-type semiconductor

Q.12. Consider the following statements for a MOSFET:

P: As channel length reduces, OFF-state current increases.
Q: As channel length reduces, output resistance increases.
R: As channel length reduces, threshold voltage remains constant.
S: As channel length reduces, ON current increases.

Which of the above statements are INCORRECT?

[GATE EC 2016]

a. P and Q

b. P and S

c. Q and R

d. R and S

Q.13. Consider the constant current source shown in the figure. Let β represent the current gain of the transistor.

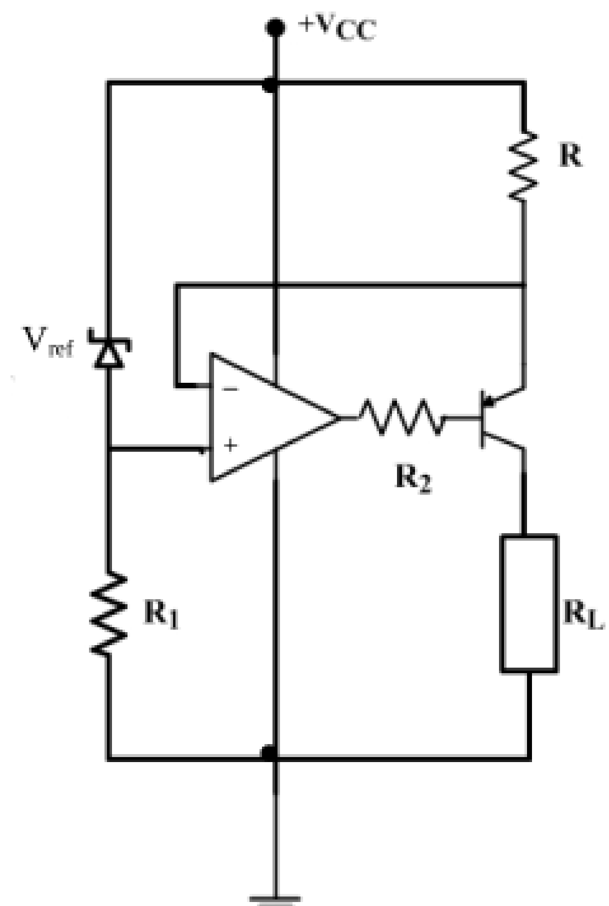

Figure 4: Constant current source (Q.13)

The load current I_0 through R_L is
[GATE EC 2016]

a. $I_0 = \frac{\beta+1}{\beta}\frac{V_{\text{ref}}}{R}$

b. $I_0 = \frac{\beta}{\beta+1}\frac{V_{\text{ref}}}{R}$

c. $I_0 = \frac{\beta+1}{\beta}\frac{V_{\text{ref}}}{2R}$

d. $I_0 = \frac{\beta}{\beta+1}\frac{V_{\text{ref}}}{2R}$

Q.14. The following signal V_i of peak voltage 8 V is applied to the non-inverting terminal of an ideal op-amp. The transistor has $V_{BE} = 0.7\,\text{V}$, $\beta = 100$, $V_{LED} = 1.5\,\text{V}$, $V_{CC} = 10\,\text{V}$ and $-V_{CC} = -10\,\text{V}$.

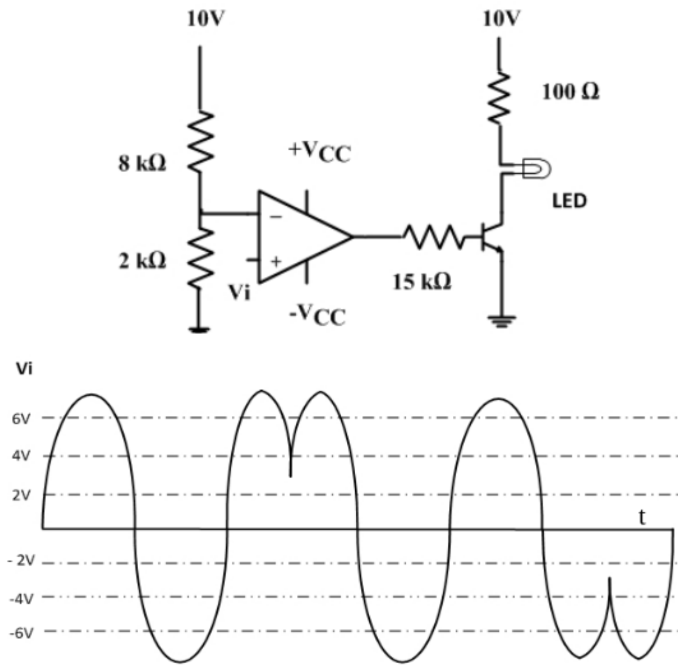

Figure 5: Signal and LED circuit (Q.14)

The number of times the LED glows is ____________.
[GATE EC 2016]

Q.15. Consider the oscillator circuit shown in the figure. The function of the network (100 kΩ in series with two back-to-back diodes) shown in dotted lines is to:

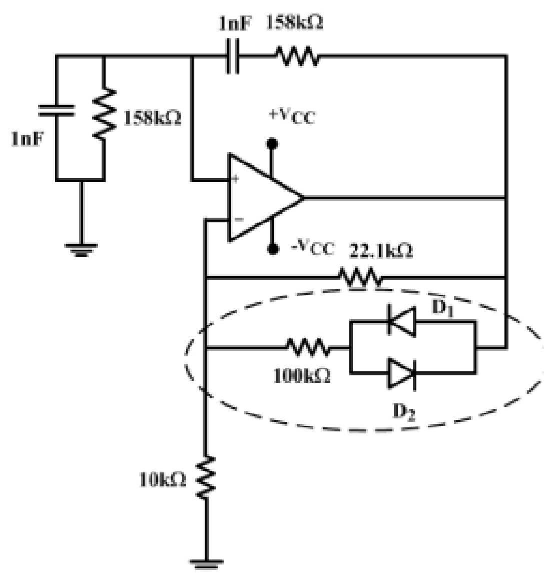

Figure 6: Oscillator (Q.15)

[GATE EC 2016]

a. introduce amplitude stabilization by preventing the op amp from saturating and thus producing sinusoidal oscillations of fixed amplitude
b. introduce amplitude stabilization by forcing the op amp to swing between positive and negative saturation and thus producing square wave oscillations of fixed amplitude
c. introduce frequency stabilization by forcing the circuit to oscillate at a single frequency
d. enable the loop gain to take on a value that produces square wave oscillations

Q.16. The block diagram of a frequency synthesizer consisting of a Phase Locked Loop (PLL) and a divide-by-N counter (comprising ÷2, ÷4, ÷8, ÷16 outputs) is sketched below. The synthesizer is excited with a 5 kHz signal (Input 1). The free-running frequency of the PLL is set to 20 kHz. Assume that the commutator switch makes contacts repeatedly in the order 1-2-3-4.

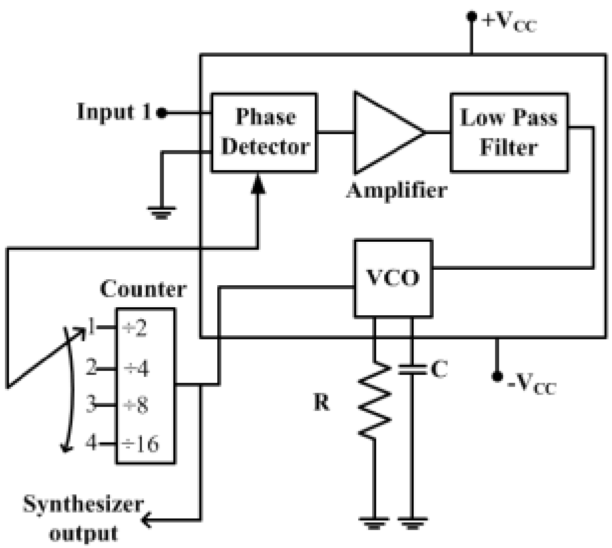

Figure 7: Combinational circuit (Q.16)

[GATE EC 2016]

a. 10 kHz, 20 kHz, 40 kHz, 80 kHz
b. 20 kHz, 40 kHz, 80 kHz, 160 kHz
c. 80 kHz, 40 kHz, 20 kHz, 10 kHz
d. 160 kHz, 80 kHz, 40 kHz, 20 kHz

Q.17. The output of the combinational circuit given below is:

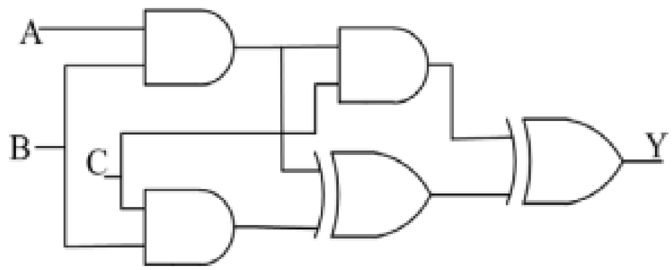

Figure 8: Combinational circuit (Q.17)

[GATE EC 2016]

a. $A + B + C$

b. $A(B + C)$

c. $B(C + A)$

d. $C(A + B)$

Q.18. What is the voltage V_{out} in the circuit shown?

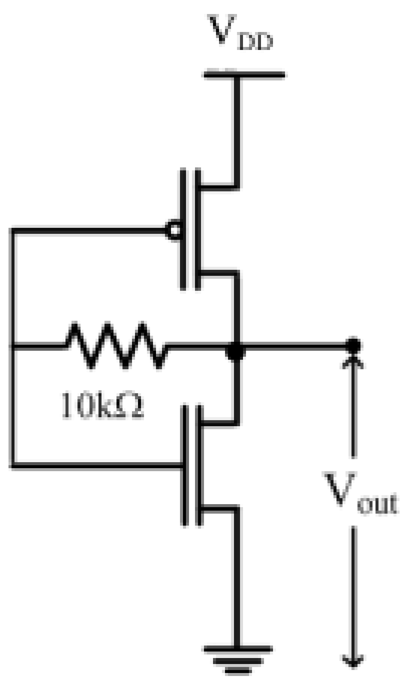

Figure 9: Circuit for Q.18

[GATE EC 2016]

a. 0 V

b. $(|V_{T,p}| + V_{T,n})/2$

c. Switching threshold of inverter

d. V_{DD}

Q.19. Match the inferences X, Y, Z about a system to properties P, Q, R of the first column in Routh's table:

X: The system is stable ...	P: ... when all elements are positive
Y: The system is unstable ...	Q: ... when any one element is zero
Z: The test breaks down ...	R: ... when there is a change in sign of coefficients

[GATE EC 2016]

a. X→P, Y→Q, Z→R

b. X→Q, Y→P, Z→R

c. X→R, Y→Q, Z→P

d. X→P, Y→R, Z→Q

Q.20. A closed-loop control system is stable if the Nyquist plot of the corresponding open-loop transfer function
[GATE EC 2016]

a. encircles the s-plane point $(-1 + j0)$ in the counterclockwise direction as many times as the number of right-half s-plane poles.

b. encircles the s-plane point $(0 - j1)$ in the clockwise direction as many times as the number of right-half s-plane poles.

c. encircles the s-plane point $(-1 + j0)$ in the counterclockwise direction as many times as the number of left-half s-plane poles.

d. encircles the s-plane point $(-1 + j0)$ in the counterclockwise direction as many times as the number of right-half s-plane zeros.

Q.21. Consider binary data transmission at a rate of 56 kbps using baseband binary PAM designed to have a raised-cosine spectrum. The transmission bandwidth (in kHz) required for a roll-off factor of 0.25 is ____________.
[GATE EC 2016]

Q.22. A superheterodyne receiver operates in the frequency range 58 MHz–68 MHz. The intermediate frequency f_{IF} and local oscillator frequency f_{LO} are chosen such that $f_{IF} \leq f_{LO}$. It is required that the image frequencies fall outside the 58–68 MHz band. The minimum required f_{IF} (in MHz) is ____________.
[GATE EC 2016]

Q.23. The amplitude of a sinusoidal carrier is modulated by a single sinusoid to obtain the AM signal

$$s(t) = 5\cos(1600\pi t) + 20\cos(1800\pi t) + 5\cos(2000\pi t).$$

The modulation index is ____________.
[GATE EC 2016]

Q.24. Concentric spherical shells of radii 2 m, 4 m and 8 m carry uniform surface charge densities of $20\,\text{nC/m}^2$, $-4\,\text{nC/m}^2$ and ρ_s, respectively. The value of ρ_s (nC/m^2) required to ensure that the electric flux density $\mathbf{D} = \mathbf{0}$ at radius 10 m is ____________.
[GATE EC 2016]

Q.25. The propagation constant of a lossy transmission line is $(2 + j5)\ \mathrm{m}^{-1}$ and its characteristic impedance is $(50 + j0)\ \Omega$ at $\omega = 10^6$ rad/s. The values of the line constants L, C, R, G are, respectively:

[GATE EC 2016]

a. $L = 200\ \mu\mathrm{H/m},\ C = 0.1\ \mu\mathrm{F/m},\ R = 50\ \Omega/\mathrm{m},\ G = 0.02\ \mathrm{S/m}$

b. $L = 250\ \mu\mathrm{H/m},\ C = 0.1\ \mu\mathrm{F/m},\ R = 100\ \Omega/\mathrm{m},\ G = 0.04\ \mathrm{S/m}$

c. $L = 200\ \mu\mathrm{H/m},\ C = 0.2\ \mu\mathrm{F/m},\ R = 100\ \Omega/\mathrm{m},\ G = 0.02\ \mathrm{S/m}$

d. $L = 250\ \mu\mathrm{H/m},\ C = 0.2\ \mu\mathrm{F/m},\ R = 50\ \Omega/\mathrm{m},\ G = 0.04\ \mathrm{S/m}$

Q.26 – Q.55 carry two marks each.

Q.26. Evaluate

$$\frac{1}{2\pi}\iint_D (x + y + 10)\,dx\,dy,$$

where D denotes the disc $x^2 + y^2 \leq 4$. The value is ________.

[GATE EC 2016]

Q.27. A sequence $x[n]$ is specified as

$$\begin{pmatrix} x[n] \\ x[n-1] \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}^n \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad \text{for } n \geq 2.$$

The initial conditions are $x[0] = 1$, $x[1] = 1$, and $x[n] = 0$ for $n < 0$. The value of $x[12]$ is ________.

[GATE EC 2016]

Q.28. In the integral below the contour C encloses the points $2\pi j$ and $-2\pi j$:

$$\frac{1}{2\pi j}\oint_C \frac{\sin z}{(z - 2\pi j)^3}\,dz.$$

The value of the integral is ________.

[GATE EC 2016]

Q.29. The region specified by $\{(\rho, \phi, z) : 3 \leq \rho \leq 5,\ \frac{\pi}{8} \leq \phi \leq \frac{\pi}{4},\ 3 \leq z \leq 4.5\}$ in cylindrical coordinates has volume of ________.

[GATE EC 2016]

Q.30. The Laplace transform of the causal periodic square wave of period T shown in the figure below is:

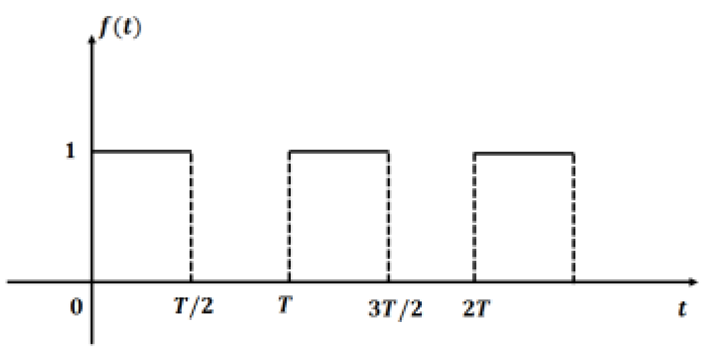

Figure 10: Periodic square wave (Q.30)

[GATE EC 2016]

a. $F(s) = \dfrac{1}{1 + e^{-sT/2}}$

b. $F(s) = \dfrac{1}{s(1 + e^{-sT/2})}$

c. $F(s) = \dfrac{1}{s(1 - e^{-sT})}$

d. $F(s) = \dfrac{1}{1 - e^{-sT}}$

Q.31. A network consisting of a finite number of linear resistor (R), inductor (L), and capacitor (C) elements, connected all in series or all in parallel, is excited with a source of the form

$$\sum_{k=1}^{3} a_k \cos(k\omega_0 t), \quad \text{where } a_k \neq 0,\ \omega_0 \neq 0.$$

The source has nonzero impedance. Which one of the following is a possible form of the output measured across a resistor in the network?
[GATE EC 2016]

a. $\sum_{k=1}^{3} b_k \cos(k\omega_0 t + \phi_k)$, where $b_k \neq a_k \; \forall k$

b. $\sum_{k=1}^{4} b_k \cos(k\omega_0 t + \phi_k)$, where $b_k \neq 0 \; \forall k$

c. $\sum_{k=1}^{3} a_k \cos(k\omega_0 t + \phi_k)$

d. $\sum_{k=1}^{2} a_k \cos(k\omega_0 t + \phi_k)$

Q.32. A first-order low-pass filter of time constant T is excited with different input signals (with zero initial conditions up to $t = 0$). Match the excitation signals X, Y, Z with the corresponding time responses for $t \geq 0$:

X: Impulse	P: $1 - e^{-t/T}$
Y: Unit step	Q: $t - T(1 - e^{-t/T})$
Z: Ramp	R: $e^{-t/T}$

[GATE EC 2016]

a. X → R, Y → Q, Z → P

b. X → Q, Y → P, Z → R

c. X → R, Y → P, Z → Q

d. X → P, Y → R, Z → Q

Q.33. An AC voltage source $V = 10\sin(t)$ volts is applied to the network shown in the figure. Assume $R_1 = 3$ kΩ, $R_2 = 6$ kΩ and $R_3 = 9$ kΩ, and that the diode is ideal.

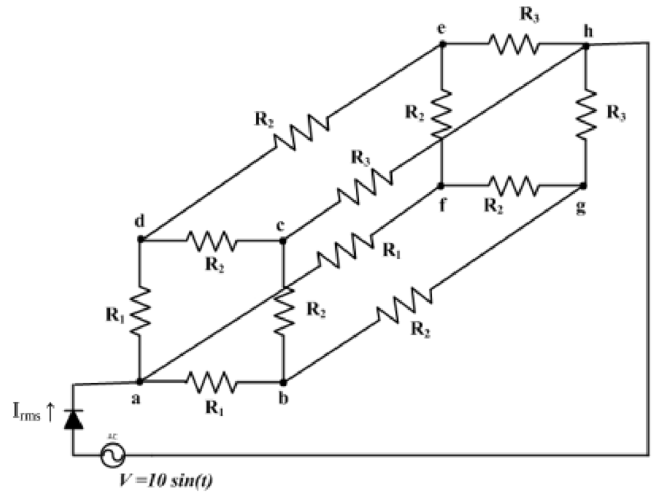

Figure 11: Network for Q.33

RMS current I_{rms} (in mA) through the diode is ____________.
[GATE EC 2016]

Q.34. In the circuit shown, the maximum power (in watt) delivered to the resistor R is ____________.

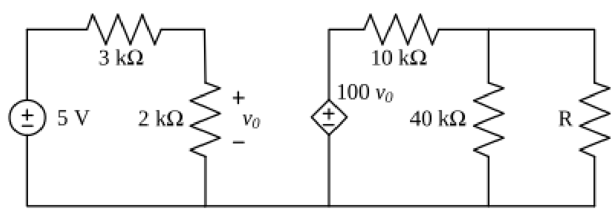

Figure 12: Circuit for Q.34

[GATE EC 2016]

Q.35. Consider the signal

$$x[n] = 6\delta[n+2] + 3\delta[n+1] + 8\delta[n] + 7\delta[n-1] + 4\delta[n-2].$$

If $X(e^{j\omega})$ is the discrete-time Fourier transform of $x[n]$, then

$$\frac{1}{\pi}\int_{-\pi}^{\pi} X(e^{j\omega})\,\sin^2(2\omega)\,d\omega$$

is equal to ____________.
[GATE EC 2016]

Q.36. Consider a silicon p–n junction with a uniform acceptor doping concentration of $10^{17}\,\text{cm}^{-3}$ on the p-side and a uniform donor doping concentration of $10^{16}\,\text{cm}^{-3}$ on the n-side. No external voltage is applied to the diode. Given: $kT/q = 26$ mV,

$n_i = 1.5 \times 10^{10}\,\text{cm}^{-3}$, $\varepsilon_{\text{Si}} = 12\varepsilon_0$, $\varepsilon_0 = 8.85 \times 10^{-14}\,\text{F/m}$, and $q = 1.6 \times 10^{-19}\,\text{C}$. The charge per unit junction area (nC cm^{-2}) in the depletion region on the p-side is ______.

[GATE EC 2016]

Q.37. Consider an n-channel MOSFET with gate-to-source voltage $V_{GS} = 1.8\,\text{V}$. Assume $W/L = 4$, $\mu_n C_{\text{ox}} = 70 \times 10^{-6}\,\text{A/V}^2$, threshold voltage $V_T = 0.3\,\text{V}$, and channel-length modulation parameter $\lambda = 0.09\ \text{V}^{-1}$. In the saturation region, the drain conductance (in μS) is ______.

[GATE EC 2016]

Q.38. The figure below shows the doping distribution in a p-type semiconductor (log scale). The magnitude of the electric field (in kV/cm) in the semiconductor due to non-uniform doping is ______.

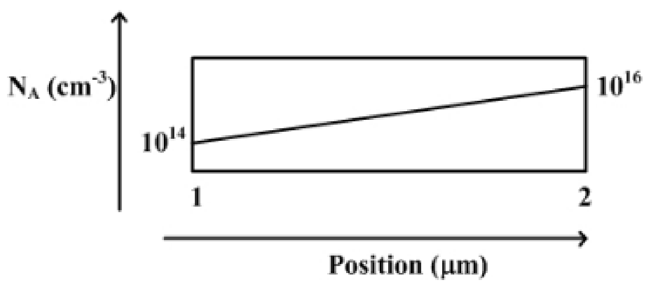

Figure 13: Doping profile (Q.38)

[GATE EC 2016]

Q.39. Consider a silicon sample at $T = 300\,\text{K}$, with uniform donor density $N_d = 5 \times 10^{16}\ \text{cm}^{-3}$, illuminated uniformly with an optical generation rate of $G_{\text{opt}} = 1.5 \times 10^{20}\ \text{cm}^{-3}\text{s}^{-1}$. The incident radiation is turned off at $t = 0$. Assume low-level injection and ignore surface effects. The carrier lifetimes are $\tau_{p0} = 0.1\,\mu\text{s}$ and $\tau_{n0} = 0.5\,\mu\text{s}$. The excess carrier concentrations Δn and Δp immediately after $t = 0$ are

[GATE EC 2016]

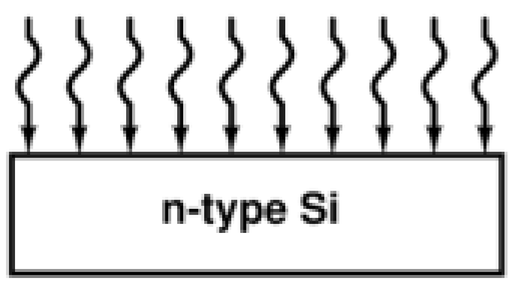

Figure 14: Silicon sample under optical illumination

A. 1.5×10^{13} cm^{-3} and 7.47×10^{11} cm^{-3}
B. 1.5×10^{13} cm^{-3} and 8.23×10^{11} cm^{-3}
C. 7.5×10^{13} cm^{-3} and 3.73×10^{11} cm^{-3}
D. 7.5×10^{13} cm^{-3} and 4.12×10^{11} cm^{-3}

Q.40. An ideal op-amp has voltage sources $V_1, V_3, V_5, \ldots, V_{N-1}$ connected to the non-inverting input and $V_2, V_4, V_6, \ldots, V_N$ connected to the inverting input as shown. The voltages are $1, -\frac{1}{2}, \frac{1}{3}, -\frac{1}{4}, \ldots$ volts, respectively. As $N \to \infty$, the output voltage (in volt) is _______.
[GATE EC 2016]

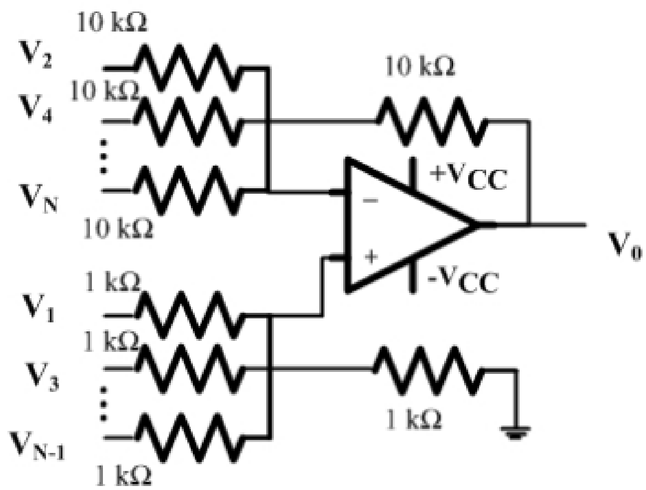

Figure 15: Op-amp with infinite input series

Q.41. A p-i-n photodiode of responsivity 0.8 A/W is connected to the inverting input of an ideal op-amp as shown. If 10 μW optical power is incident, the photocurrent (in μA) through the load resistor $R_L = 10\,\mathrm{k}\Omega$ is _______.
[GATE EC 2016]

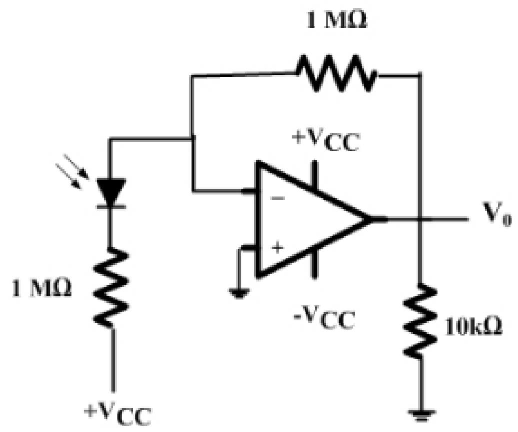

Figure 16: Photodiode with op-amp load

Q.42. Identify the circuit below.
[GATE EC 2016]

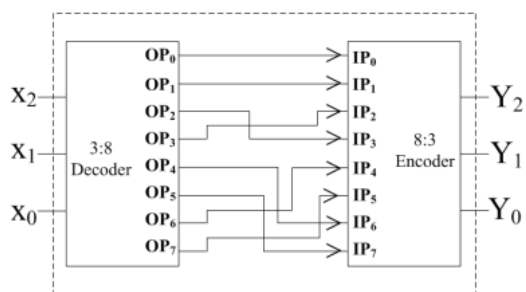

Figure 17: Logic circuit

A. Binary to Gray code converter
B. Binary to XS-3 converter
C. Gray to Binary converter
D. XS-3 to Binary converter

Q.43. The functionality implemented by the circuit shown is
[GATE EC 2016]

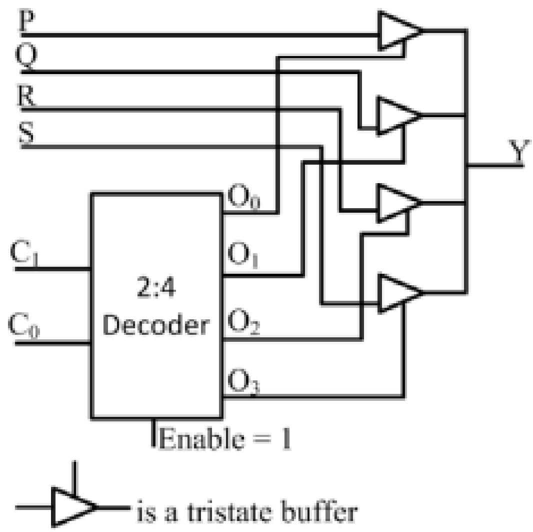

Figure 18: Combinational logic circuit

A. 2-to-1 multiplexer
B. 4-to-1 multiplexer
C. 7-to-1 multiplexer
D. 6-to-1 multiplexer

Q.44. In an 8085 system, a PUSH requires more cycles than a POP. The reason is **[GATE EC 2016]**

A. POP uses memory→processor like fetch, PUSH reverses direction
B. Memory write is slower than memory read
C. Stack pointer must pre-decrement before PUSH
D. Order of registers is interchanged for PUSH

Q.45. The open-loop transfer function of a unity-feedback system is

$$G(s) = \frac{K}{s^2 + 5s + 5}.$$

[GATE EC 2016]
The value of K at the breakaway point of the root-locus is _______.

Q.46. For

$$G(s) = \frac{K}{s(s + 2)},$$

[GATE EC 2016]
the value of K for 10% peak overshoot is _______.

Q.47. The transfer function

$$H(s) = 2s^4 - 5s^3 + 5s - 2$$

[GATE EC 2016]
has how many zeros in the right half-plane? _______

Q.48. A discrete memoryless source with alphabet $S = \{s_0, s_1, \ldots\}$ and probabilities

$$P = \left\{\tfrac{1}{2}, \tfrac{1}{4}, \tfrac{1}{8}, \tfrac{1}{16}, \ldots\right\}$$

[GATE EC 2016]
has entropy (bits) equal to ______.

Q.49. A 3-repetition code is used over a BSC with $p = 0.1$, with majority decoding. The average probability of error is ______.
[GATE EC 2016]

Q.50. An analog pulse $s(t)$ is transmitted over AWGN. At filter output, $\text{SNR}_{\max}$ equals?
[GATE EC 2016]

A. $E_s = E_h$, $\text{SNR}_{\max} = 2E_s/N_0$
B. $E_s = E_h$, $\text{SNR}_{\max} = E_s/2N_0$
C. $E_s > E_h$, $\text{SNR}_{\max} > 2E_s/N_0$
D. $E_s < E_h$, $\text{SNR}_{\max} = 2E_h/N_0$

Q.51. Current density

$$\mathbf{J} = \frac{400 \sin\theta}{2\pi(r^2 + 4)} \hat{a}_r \text{ A/m}^2$$

[GATE EC 2016]
The total current and average current density through surface $r = 0.8\,\text{m}$, $\pi/12 \leq \theta \leq \pi/4$ are

A. 15.09 A, 12.86 A/m^2
B. 18.73 A, 13.65 A/m^2
C. 12.86 A, 9.23 A/m^2
D. 10.28 A, 7.56 A/m^2

Q.52. Antenna with $T_{ant} = 50\text{K}$, amplifier NF = 2 dB, BW = 12 MHz. Find T_e and P_{ao}.
[GATE EC 2016]

A. $T_e = 169.36$ K, $P_{ao} = 3.73 \times 10^{-10}$ W
B. $T_e = 170.8$ K, $P_{ao} = 4.56 \times 10^{-10}$ W
C. $T_e = 182.5$ K, $P_{ao} = 3.85 \times 10^{-10}$ W
D. $T_e = 160.62$ K, $P_{ao} = 4.6 \times 10^{-10}$ W

Q.53. Two horn antennas, distance 200λ, $\Gamma_t = 0.15$, $\Gamma_r = 0.18$, $G_t = 18$ dB, $G_r = 22$ dB, $P_{in} = 2$ W. Power delivered at receiver (mW) is ______.
[GATE EC 2016]

Q.54. Incident field

$$\mathbf{E}_{\text{inc}} = (\hat{a}_x + j\hat{a}_y)E_0 e^{jkz}, \qquad \mathbf{E}_a = (\hat{a}_x + 2\hat{a}_y)\frac{E_I}{r} e^{-jkr}$$

[GATE EC 2016]
Polarization and mismatch loss are

A. Linear, Circular (CW), −5 dB
B. Circular (CW), Linear, −5 dB
C. Circular (CW), Linear, −3 dB
D. Circular (ACW), Linear, −3 dB

Q.55. Helical antenna with far-zone density

$$W_{\text{rad}}(\hat{r}) = \frac{arC_0}{r^2} \cos^4 \theta$$

[GATE EC 2016]

Radiated power and directivity are

A. $1.5C_0$, 10 dB

B. $1.256C_0$, 10 dB

C. $1.256C_0$, 12 dB

D. $1.5C_0$, 12 dB