GATE 2026 Electronics and Communication Engineering (ECE) Question Paper

Time Allowed :3 Hour	**Maximum Marks :**100	**Total Questions :**65

General Instructions

Please read the following instructions carefully:

1. This question paper is divided into three sections:
   - **General Aptitude (GA):** 10 questions (5 questions × 1 mark + 5 questions × 2 marks) for a total of 15 marks.
   - **Environmental Science and Engineering + Engineering Mathematics:**
     - **Part A (Mandatory):** 36 questions (1 questions × 1 mark + 19 questions × 2 marks) for a total of 55 marks.
     - **Part B (Section 1):** Candidates can choose either Part B1 (Surveying and Mapping) or Part B2 (Section 2). Each part contains 16 questions (8 questions × 1 mark + 11 questions × 2 marks) for a total of 30 marks.
2. The total number of questions is **65**, carrying a maximum of **100 marks**.
3. The duration of the exam is **3 hours**.
4. Marking scheme:
   - For 1-mark MCQs, $\frac{1}{3}$ mark will be deducted for every incorrect response.
   - For 2-mark MCQs, $\frac{2}{3}$ mark will be deducted for every incorrect response.
   - No negative marking for numerical answer type (NAT) questions.
   - No marks will be awarded for unanswered questions.
5. Ensure you attempt questions only from the optional section (Part B1 or Part B2) you have selected.
6. Follow the instructions provided during the exam for submitting your answers.

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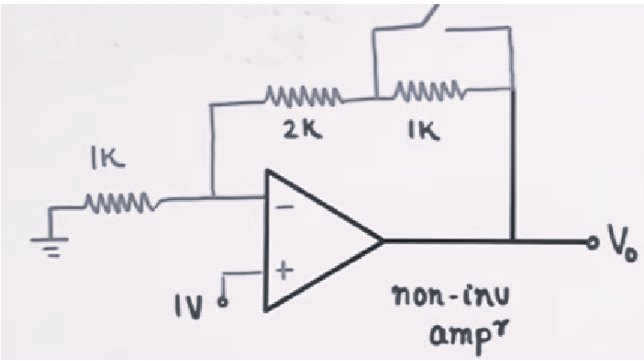
1. For the non-inverting amplifier shown in the figure, the input voltage is 1 V. The feedback network consists of 2 kΩ and 1 kΩ resistors as shown.
If the switch is open, $V_o = x$.
If the switch is closed, $V_o =$ ____x.



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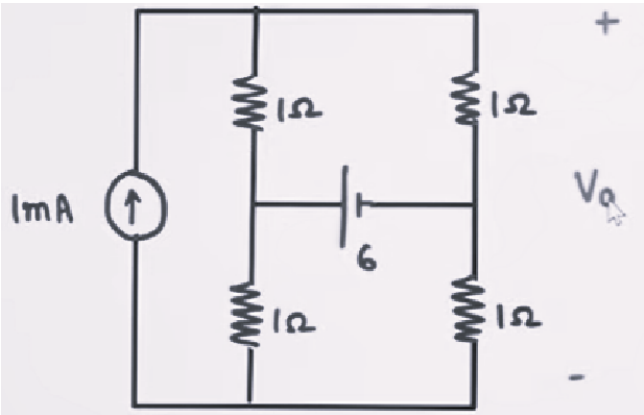
2. In the given circuit, all resistors are 1 kΩ. A 1 mA current source is connected between the top and bottom nodes. A 6 V source connects the midpoints of the two vertical branches as shown. Find the output voltage V_0.



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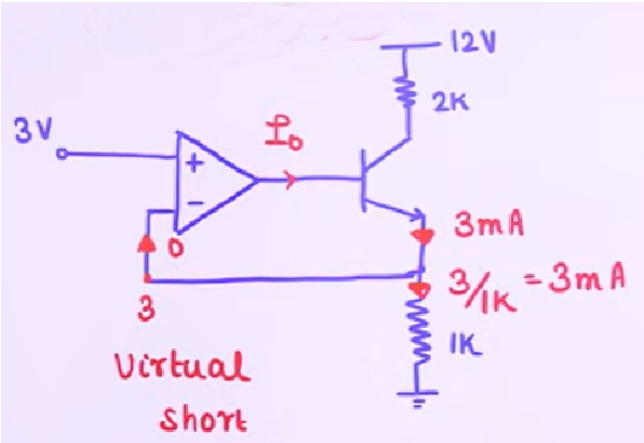
3. In the given circuit, the non-inverting input of the op-amp is at 3 V. The op-amp drives the base of a transistor as shown. The emitter is connected to a 1 kΩ resistor to ground and the collector is connected to 12 V through a 2 kΩ resistor. Find the output current I_o supplied by the op-amp.



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4. If

$$\log_{p^{1/2}} y \times \log_{y^{1/2}} p = 16,$$

then find the value of the given expression.

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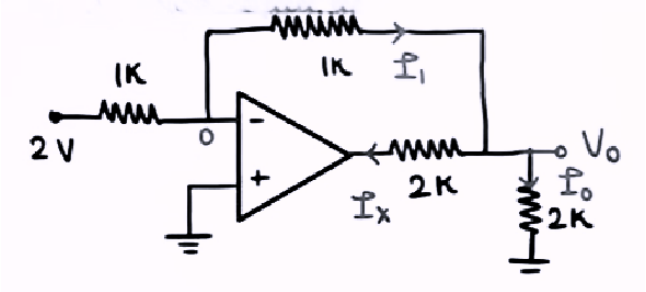
5. In the given op-amp circuit, the non-inverting terminal is grounded. The input voltage is 2 V applied through 1 kΩ. The feedback resistor is 1 kΩ. The output is connected to a 2 kΩ load to ground and also through a 2 kΩ resistor to the op-amp output. Find the output voltage V_0 and currents I_1, I_0, and I_x.



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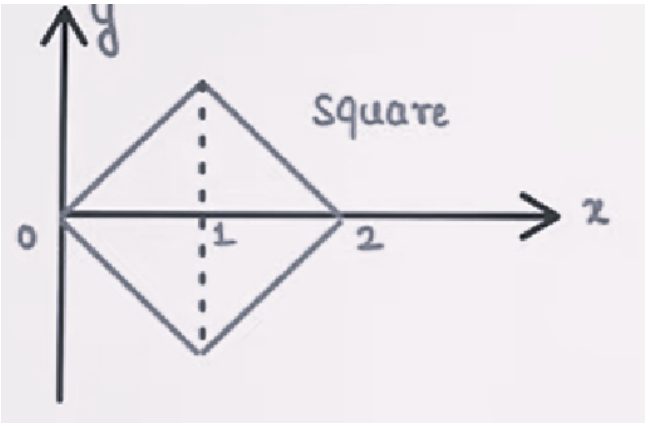
6. Find the area of the square shown in the figure whose vertices are at $(0, 0)$, $(1, 1)$, $(2, 0)$ and $(1, -1)$.



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7. Consider the system described by the difference equation

$$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}(4-n) + x(n).$$

Determine whether the system is linear and time-invariant (LTI).

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8. Given the state-space system:

$$\dot{x} = \begin{bmatrix} -4 & -1.5 \\ 4 & 0 \end{bmatrix} x + \begin{bmatrix} 2 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 0.15 & 0.625 \end{bmatrix} x$$

Find the Transfer Function (TF).

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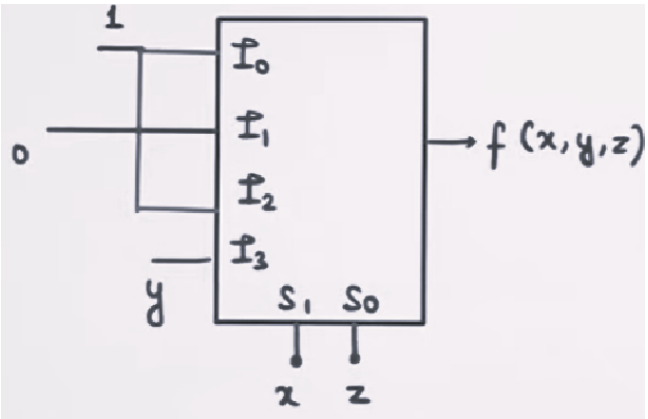
9. The figure shows a 4-to-1 multiplexer. The inputs are connected as:
$I_0 = 1, \quad I_1 = 0, \quad I_2 = 1, \quad I_3 = y.$
The select lines are $S_1 = x$ **and** $S_0 = z.$
Find the Boolean function $f(x, y, z).$



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10. f(w, x, y, z) = Σ (0, 2, 5, 7, 8, 10, 13, 14, 15)

Find the correct simplified expression.

(A) xz + wxy + w$\overline{x}\,\overline{z} + \overline{w}xy\overline{z}$
(B)$\overline{x}\,\overline{z} + wxy + w\overline{x}\,\overline{z} + \overline{w}xy\overline{z}$
(C)$\overline{x}\,\overline{z} + xz + wy\overline{z}$
(D)$\overline{x}\,\overline{z} + xz + wxy$

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11. mod-64 ripple counter can be designed using
(A) 4
(B) 5
(C) 6
(D) 7

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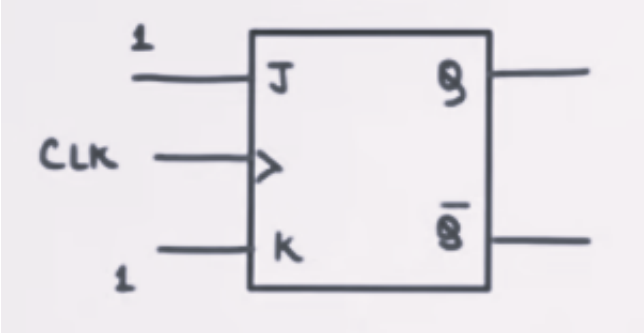
12. A JK flip-flop has inputs $J = 1$ and $K = 1$.
The clock input is applied as shown. Find the output clock cycles per second (output frequency).



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13. Find $P_1 + P_2 + \cdots + P_{10}$ if P_k is the perimeter of a square having side length k.

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14. $(\log_p^{1/n} y)(\log_y^{1/n} p) = 16$, where n, p, y are positive integers then the value of n is:

(a) 16
(b) 8
(c) 4
(d) 2

---

15. P_k = Perimeter of square and length of side is k, then $P_1 + P_2 + P_3 + \cdots + P_{10}$ is:

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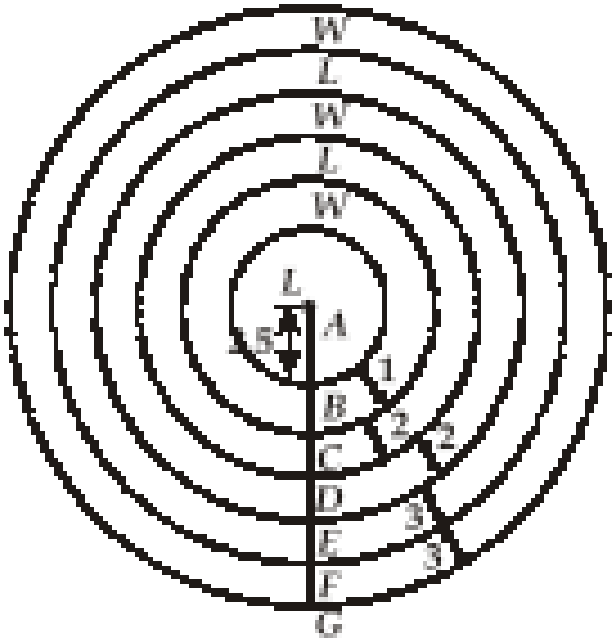
16. Consider the following circuit. If $AB = 2.5$, $BC = 1$, $CD = DE = 2$ and $EF = FC = 3$, then the ratio of area of land (L) and to water (W) is _____.



(a) 0.75
(b) 0.25
(c) 0.45
(d) 1.00

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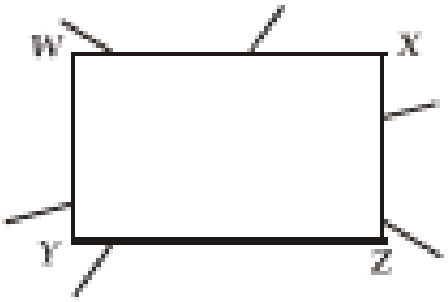
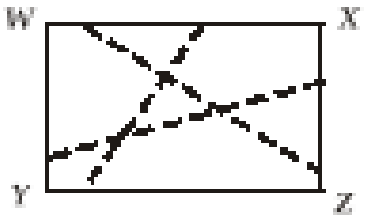
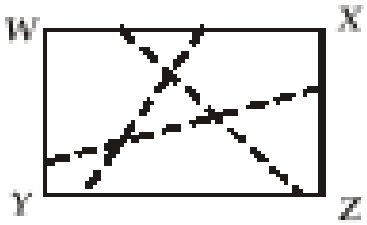
17. Find the remaining part of the given diagram:



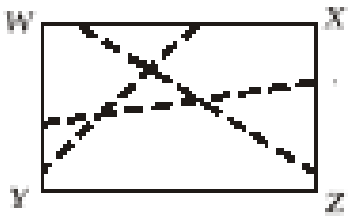
(a)



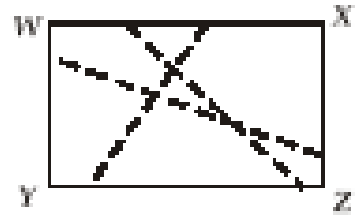
(b)



(c)



(d)



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18. Find the antonym of nocturnal.

(a) normal
(b) abnormal
(c) diurnal
(d) exceptional

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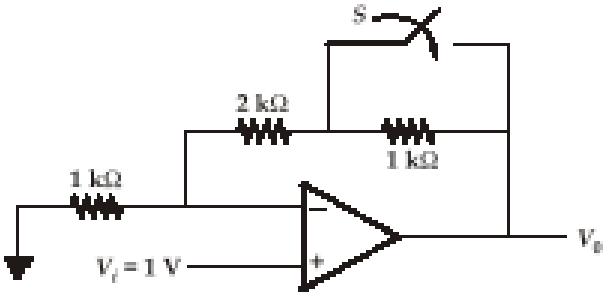
19. Consider the op-amp shown in figure below: If V_0 is 'x' when switch is open after closed the switch, the output V_0 is



(a) x
(b) $\frac{3x}{4}$
(c) $\frac{x}{2}$
(d) $2x$

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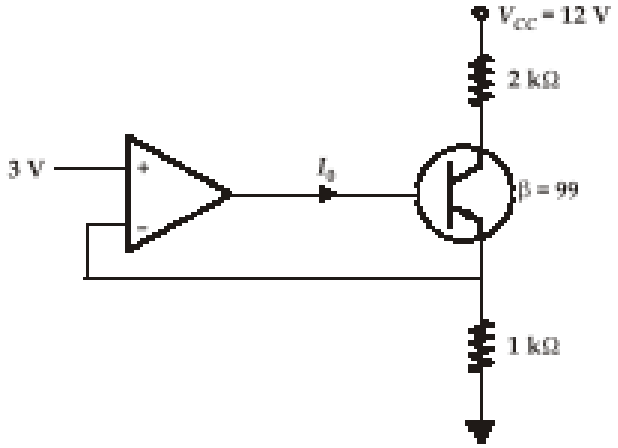
20. For transistor shown below, if β is 99, then the value of I_0 is



(a) 3 µA
(b) 30 mA
(c) 3 mA
(d) 30 µA

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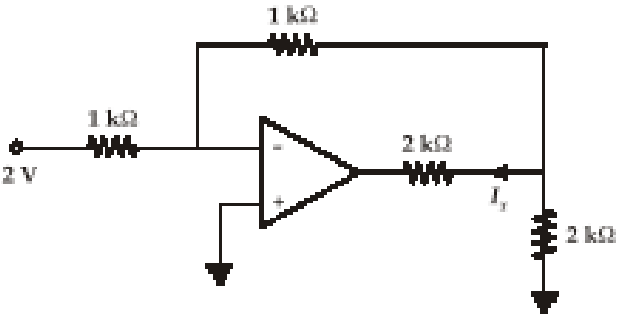
21. Consider the op-amp shown below: For $V_{in} = 2$ V, the current I_x is



(a) 3 mA
(b) 1 mA
(c) 2 mA
(d) 4 mA

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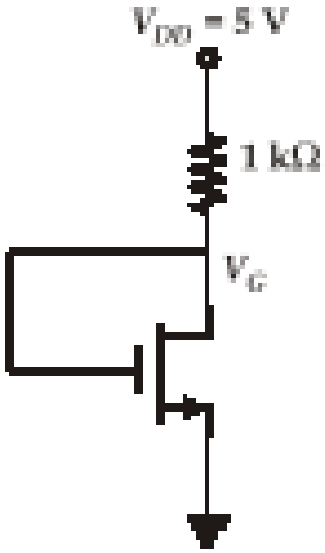
22. Consider the MOSFET shown below: If $V_T = 1$ V; $\mu_n C_{ox}\left(\frac{W}{L}\right) = 2$ mA/V^2 then find V_G.



(a) 3 V
(b) 2 V
(c) 1 V
(d) 0 V

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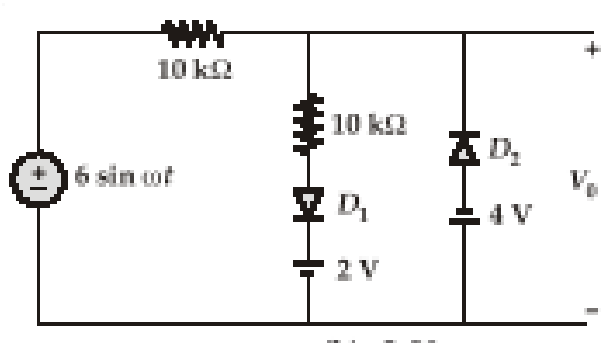
23. Find maximum V_0.



(a) 4 V
(b) 3 V
(c) 2 V
(d) 1 V

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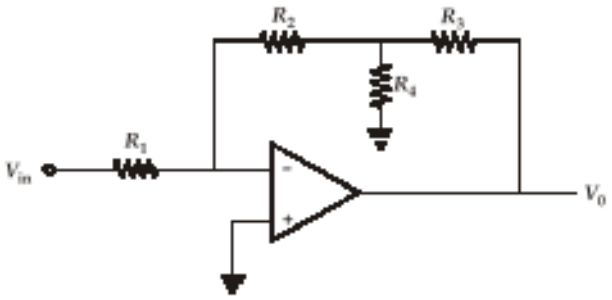
24. Consider the op-amp circuit shown below: If $R_1 = R_2 = R_3 = R_4 = 50$ kΩ, then the magnitude of gain is _____.



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25. For a 16 QAM system bit rate $R_b = 4$ Mbps. Find minimum BW (in MHz) of the system is _____.

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26. If $\frac{E_b}{N_0} = 8.4$ dB, find probability of error for QPSK modulation.

(a) 10^{-4}
(b) 10^{-6}
(c) 10^{-2}
(d) 10^{-3}

---

27. Find the channel capacity of a system using Shannon Hartley Law of a signal whose bandwidth is 1 MHz, signal power is -80 dBm, $kT = -174$ dBm/Hz.

(a) $C = B$
(b) $C = 2B$
(c) $C > 3B$
(d) $C < B$

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28. Given, (7, 4, 1) Hamming code and BER = 0.1 Prove that decoder will fail to decode received codeword properly will be

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29. If the starting address of a 256KB memory is 2500H, then find the address of the final location.

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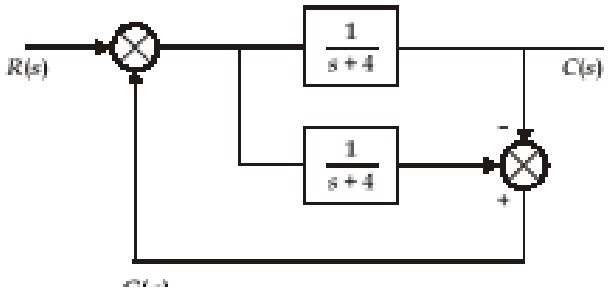
30. Find the 10's complement of $(47)_{10}$.

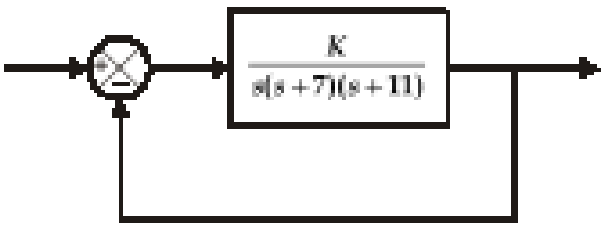
31. Consider the closed loop system as shown in figure below: The transfer function, $\frac{C(s)}{R(s)}$ of the system is



(a) $\frac{1}{s+4}$
(b) $\frac{s+4}{s+5}$
(c) $\frac{1}{s^2+8s}$
(d) $\frac{2}{s+4}$

---

32. If $\dot{X} = \begin{bmatrix} -4 & -1.5 \\ 4 & 0 \end{bmatrix} X + \begin{bmatrix} 2 \\ 0 \end{bmatrix} U$; $Y = \begin{bmatrix} 1.5 & 0.625 \end{bmatrix} X$. The $\frac{Y(s)}{U(s)}$ of the system is



(a) $\frac{3s}{s^2+4s+6}$
(b) $\frac{3s+5}{s^2+4s-6}$
(c) $\frac{3s}{s^2+4s-6}$
(d) $\frac{3s+5}{s^2+4s+6}$

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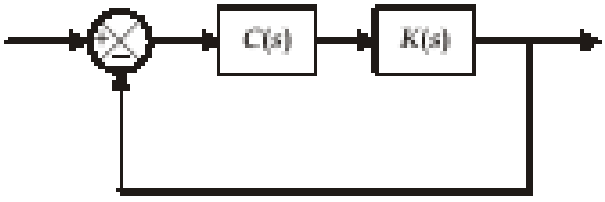
33. Consider the closed loop system shown below, Find 'K' for marginal stability.



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34. Consider the system shown below, Where, $G(s) = K(s+\alpha)$, $H(s) = \frac{1}{(s+1)(s+2)}$ and CL poles location is at $s = -3 \pm j\sqrt{5}$. Find K and α value?

35. $\dot{W} = AW$, $W(0) = \begin{bmatrix}1\\1\end{bmatrix}$, $W(t) = e^{t}\hat{u}_x + e^{-2t}\hat{u}_y$. **Find** A**?**

(a) $\begin{bmatrix}1 & 0\\0 & -2\end{bmatrix}$

(b) $\begin{bmatrix}0 & 2\\-1 & 0\end{bmatrix}$

(c) $\begin{bmatrix}0 & -2\\1 & 0\end{bmatrix}$

(d) $\begin{bmatrix}0 & 2\\0 & 2\end{bmatrix}$

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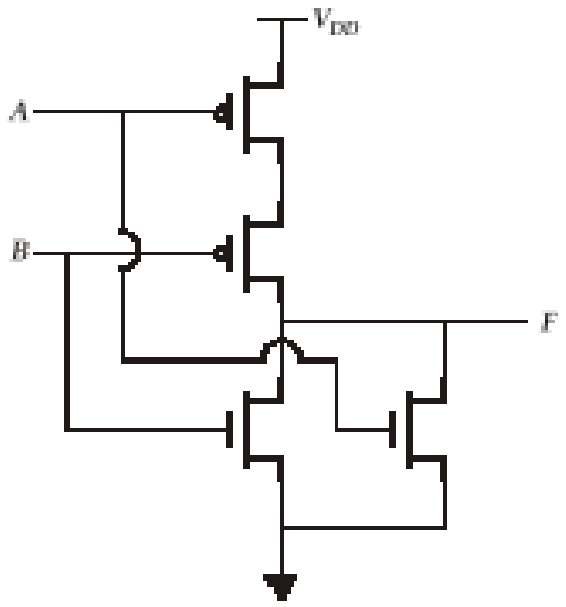
36. Find the logic function performed by the below circuit:



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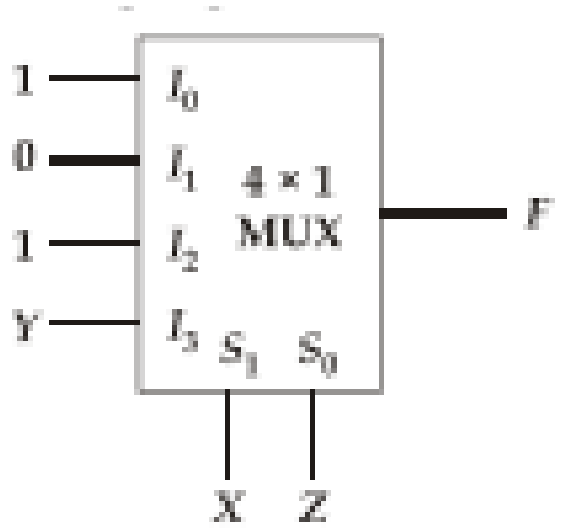
37. Find the output of the following logic circuit.



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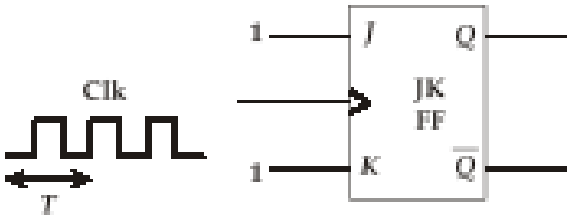
38. Consider the JK flip-flop shown below, where, $f_{clk} = 10$ clocks per second. Find the output frequency (in Hz) of flip-flop.



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39. The number of flip-flops required to design MOD-64 ripple counter using

(a) 4
(b) 5
(c) 6
(d) 7

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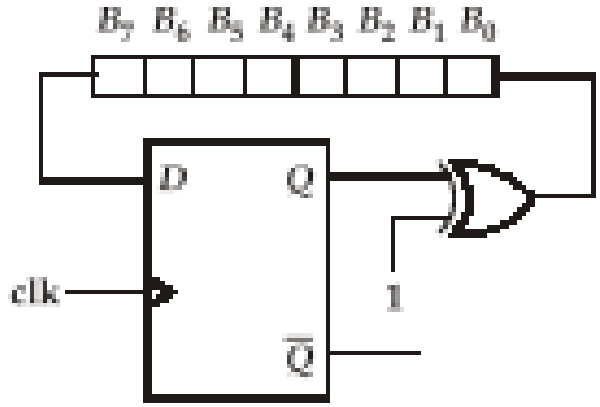
40. The logic circuit shown below is composed of Left Shift Register (LSR) and D flip-flop. Assuming all the circuits initially relaxed. Find the output after 5 clock pulse.



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41. Find the simplified boolean expression for the following logic function $f[W, X, Y, Z] = \Sigma m(0, 2, 5, 7, 8, 10, 13, 14, 15)$

(a) $XZ + WXY + W\bar{X}Z + \bar{W}XY\bar{Z}$
(b) $\bar{X}\bar{Z} + XZ + WXY$
(c) $\bar{X}\bar{Z} + XZ + W\bar{Y}Z$
(d) $\bar{X}\bar{Z} + XZ + WXY$

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42. Find the cut-off frequency (in GHz) of rectangular waveguide supporting $\mathbf{TE}_{10}$ **mode having dimensions 0.28 × 0.14 inches.**

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43. Identify the type of polarisation for the EM value given, $E = E_0[\cos(\omega t + kz)\hat{a}_x + \sin(\omega t + kz)\hat{a}_y]$

(a) Left circularly polarised
(b) Right circularly polarised
(c) Linearly polarised
(d) Left elliptically polarised

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44. If N_d **decreases linearly from** 2×10^{17} $\mathbf{cm}^{-3}$ **at** $x = 1\mu m$ **to** 1×10^{16} $\mathbf{cm}^{-3}$ **at** $x = 4\mu m$**. The region between** $x = 1\mu m$ **and** $x = 4\mu m$ **is labelled "linear". If electron mobility** $\mu_n = 1400$ $\mathbf{cm}^2$**/V-s, thermal voltage,** $V_T = \frac{kT}{q} = 25$ **mV (at** $T = 300$ **K) Then** $J_{n(diff)}$ **(in** $\mathbf{A/mm}^2$**).**

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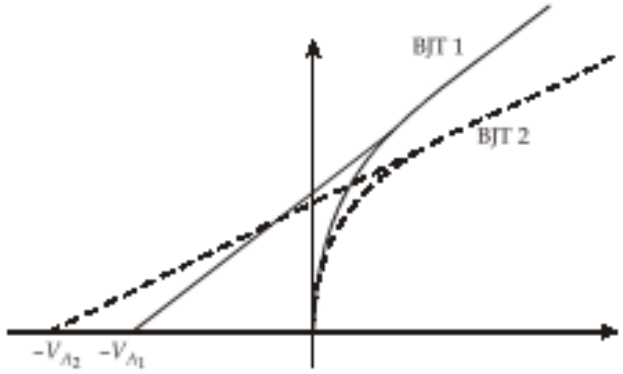
45. The characteristics curve of two transistors are given as shown below: If the early voltage of BJT 1 is V_{A1} **and the early voltage of BJT 2 is** V_{A2}**, then which of**

the following options is/are correct?



(a) V_{A2} is ∞
(b) $|V_{A1}| < |V_{A2}|$
(c) $|V_{A1}| > |V_{A2}|$
(d) V_{A2} is finite

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46. A p-n junction is forward bias with 2 volts. The magnitude of difference between quasi Fermi energy level E_{FP} and E_{FN} is

(a) 2 eV
(b) 1 eV
(c) 2 V
(d) 1 V

---

47. What is the dominant transport mechanism for current flow in zener breakdown?

(a) Drift
(b) Diffusion
(c) Ballistic transport
(d) Tunnelling

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48. If energy gap $E_G = 1.3$ eV. Which of the wavelength range will not absorbed?

(a) (850 ± 20) nm
(b) (950 ± 20) nm
(c) (1000 ± 20) nm
(d) (1040 ± 20) nm

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49. Consider the following matrix: $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 0 \\ -1 & a & b \end{bmatrix}$**, if matrix is non singular** $(|A| \neq 0)$**, then the value of** a **and** b **are**

(a) $a = b = -\frac{1}{2}$
(b) $a = -3, b = 0$
(c) $a = 1, b = 1$
(d) $a = 0, b = 1$

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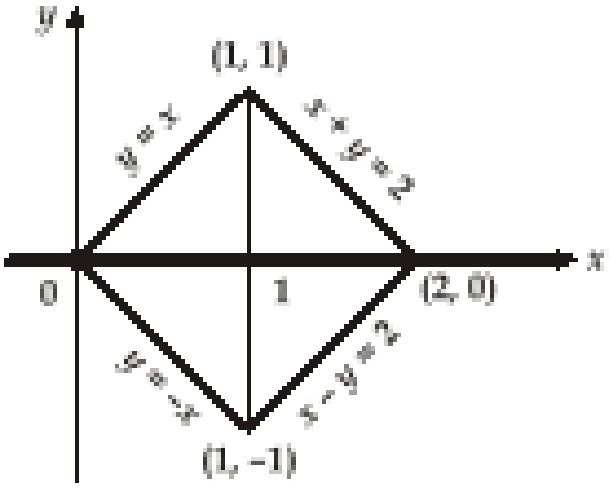
50. The value of $\int_R (x^2 + y^2 - 1)dxdy$ **is** _____**.**



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51. The value of $\oint_C \frac{(z+4)^2}{(z-i)(z-2)}dz$ **where** $C : |z - 2 - i| = \frac{1}{3}$

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52. $S_A = \sum_{n=1}^{\infty} \left(\frac{n^2}{2^n}\right)$ **and** $S_B = 1 + \frac{1}{2} + \frac{1}{4} + \cdots + \frac{1}{512}$**. Convergent (or) divergent?**

(a) S_A and S_B both are convergent
(b) S_A convergent and S_B not convergent
(c) S_A not convergent and S_B convergent
(d) S_A and S_B are not convergent

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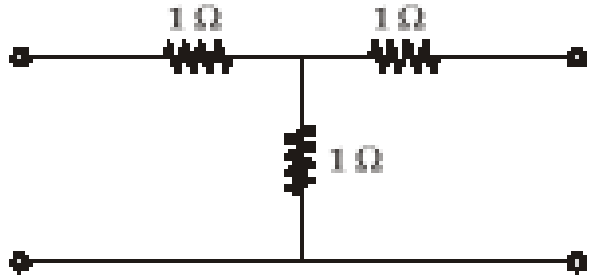
53. Find the ABCD parameter of the following two port network



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54. Find V_0 (in Volts).

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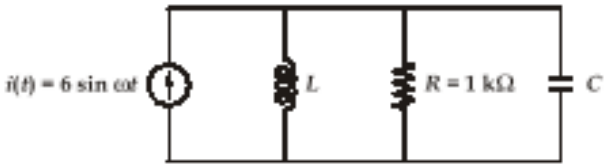
55. Find Average power (in kW) at resonance.



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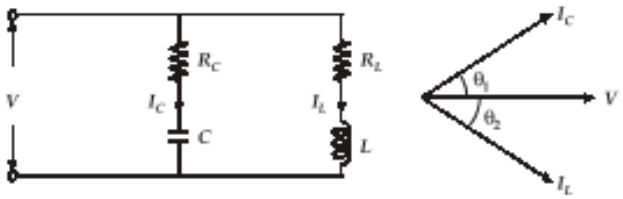
56. $\theta_1 + \theta_2 = 90^\circ$ at $f = 159.15$ Hz, $L = 1\mu H, C = 1\mu F$. Find $R_L \times R_C$.



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57. If $x(t)$ has energy E, then the ratio of energy of $\frac{E[x(t)]}{E[3x(-3t+5)]}$.

(a) 9
(b) $\frac{1}{3}$
(c) $\frac{1}{9}$
(d) 3

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58. If input-output relation of the LTI system is $y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$. The above system is

(a) Stable if causal
(b) Unstable if anti-causal

(c) Stable if non-causal
(d) Unstable if non-causal

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59. Find the Laplace transform of $x_1(t) * x_2(t)$. where, $x_1(t) = u(t-2)$, $x_2(t) = t \cdot u(t)$.

(a) $\frac{1}{s^3}$
(b) $\frac{e^{-s}}{s^3}$
(c) $\frac{e^{-2s}}{s^3}$
(d) $\frac{1}{(s-2)^3}$

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60. The impulse-response of an LTI-system is given as $h(t) = e^{-2t}u(t)$. The system is

(a) causal and unstable
(b) causal and stable
(c) non-causal and unstable
(d) non-causal and stable

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61. Consider a signal $x(t)$ given by $x(t) = e^{-2t}u(t)$. If 99% of energy of $x(t)$ lies within 'B' Hz then the value of B is _____ Hz.

(a) $\frac{126}{\pi} < B < \frac{128}{\pi}$
(b) $\frac{63}{\pi} < B < \frac{64}{\pi}$
(c) $B < \frac{63}{\pi}$
(d) None of these
