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1. The plane wave propagating through the dielectric has the magnetic field component as $H = 20e^{-ax}\cos(\omega t - 0.25x)\hat{a}_y A/m$ ($\hat{a}_x, \hat{a}_y, \hat{a}_z$ are unit vectors along x, y and z axis respectively). Determine the polarization of the wave

(A) $\hat{a}_x$ (B) $-\hat{a}_z$ (C) $\frac{a_x + a_y}{\sqrt{2}}$ (D) $\hat{a}_y$

---

2. In free space, $H = 0.1\cos(\omega t - \beta x)a_z$ A/m ($\hat{a}_x, \hat{a}_y, \hat{a}_z$ are unit vectors along x, y and z axis respectively). The total power passing through a square plate of side 10cm on plane x + 2y = 1.0, is approximately

(A) 42.12 mW (B) 16.85 mW (C) 18.84 mW (D) 8.425 mW

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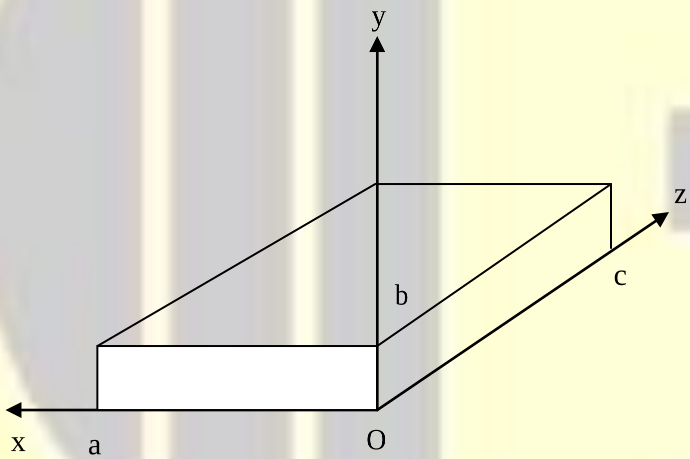
3. Consider the rectangular cavity as shown below:



If a = c > b, the dominant mode of resonance corresponding to the above rectangular cavity is

(A) TE011 (B) TE101 (C) TM110 (D) TM011

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4. A video camera generates data at a rate of 5 Mbps. The data is channel coded at rate 1/3 and 8 PSK modulated. Which of the following statements is correct?

(A) Information rate: 15 Mbps; Symbol rate: 5 Msps

(B) Information rate: 5 Mbps; Symbol rate: 5 Msps

(C) Information rate: 15 Mbps; Symbol rate: 15 Msps

(D) Information rate: 5 Mbps; Symbol rate: 5 Msps

5. Evaluate $\int_{-\infty}^{\infty} x^4 f(x)dx$ where, $f(x) = \frac{1}{\sqrt{2\pi}} e^{\left(\frac{x^2}{2}\right)}, x(-\infty, \infty)$

(A) 3 (B) $3\sqrt{\pi}$ (C) $\sqrt{3}\pi$ (D) 3π

---

6. Consider a transformation $T: R^3 \to R^2$ where R^3 and R^2 represent three and two dimensional real column vectors respectively. Also, T(x) = Ax for some matrix A and for each x in R^3. How many rows and columns does A have and what is its maximum possible rank?

(A) Rows : 3; Columns : 2; Rank : 3
(B) Rows : 3; Columns : 2; Rank : 2
(C) Rows : 2; Columns : 3; Rank : 2
(D) Rows : 2; Columns : 3; Rank : 3

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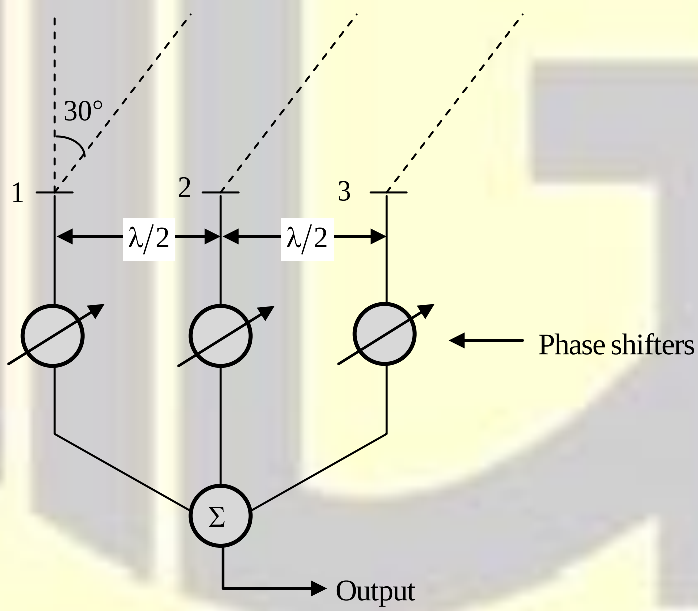
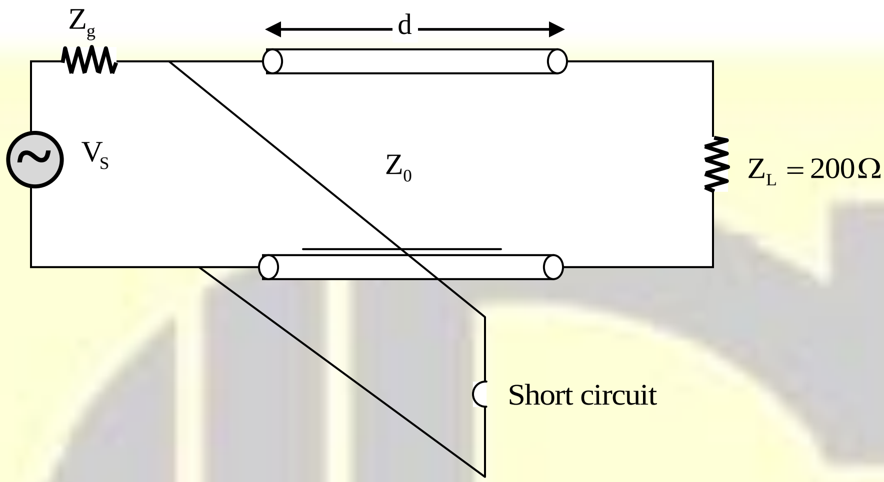
7. The output of a three element co-linear antenna array operating in a free space environment is combined (after appropriate phase shifting) to maximize the signal received from a particular direction as shown in figure.



If the inter-element spacing is half of the signal wavelength and direction of maximum response is 30° from the perpendicular to the array, what are the phases to be applied to each element? Consider the first element as the reference.

(A) $\left[-\frac{\pi}{3} \quad 0 \quad \frac{\pi}{3}\right]$ (B) $\left[-\frac{\pi}{4} \quad 0 \quad \frac{\pi}{4}\right]$ (C) $\left[0 \quad \frac{\pi}{2} \quad \pi\right]$ (D) $\left[0 \quad \frac{\pi}{4} \quad \frac{\pi}{2}\right]$

8. The transmission line of characteristic impedance 50 Ω and feeding a purely resistive load of 200 Ω uses single quarter wavelength long short-circuit stub which is placed at a distance d from the load. The VSWR on the transmission line section of length d and VSWR on the stub respectively are



(A) 0 and 0 respectively
(B) 1 and 1 respectively
(C) 4 and 1 respectively
(D) 4 and ∞ respectively

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9. The plane y = 0 carries a uniform current density of $-20\hat{k}$mA/m. The magnetic field intensity at x = 1, y= 10 and z = –2 is

(A) $-10\hat{i}$ mA/m
(B) $10\hat{i}$ mA/m
(C) $-20\hat{i}$ mA/m
(D) $20\hat{i}$ mA/m

---

10. A charge of 2C is placed near a grounded conducting plate at a distance of 1 m. The force acting between the charge of 2 C and ground conducting plate in Newton is

(A) $\frac{1}{4\pi\varepsilon}$
(B) $\frac{1}{8\pi\varepsilon}$
(C) $\frac{1}{16\pi\varepsilon}$
(D) $4\pi\varepsilon$

---

11. A data sequence x[n] = {1, 2, 3, 4, 5} passes through a linear time-invariant system with impulse response h[n] = {5, 4, 3, 2, 1}. The output of the filter will be

(A) {6, 6, 6, 6, 6}
(B) {5, 8, 9, 8, 5}
(C) {5, 14, 26, 40, 55, 40, 26, 14, 5}
(D) {1, 4, 10, 20, 35, 44, 46, 40, 25}

---

12. Consider a signal v(t) with Fourier transform V(f). If V′(f) represents the Fourier transform of v(2t), what is the relation of V′(f) to V(f)?

(A) Magnitude scaled by 0.5 and bandwidth compressed

(B) Magnitude scaled by 0.5 and bandwidth expanded

(C) Magnitude scaled by 2 and bandwidth compressed

(D) Magnitude scaled by 2 and bandwidth expanded

---

13. If one of the code words of a Hamming (7, 4) code is 0001011, which of the following cannot be the valid code word in the same group?

(A) 0011101 (B) 0101100 (C) 0011010 (D) 1110100

---

14. Which of the following digital modulations can be decoded non-coherently?

(A) QAM (B) APSK (C) BPSK (D) BFSK

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15. A mobile antenna receives two copies of the signal transmitted by the base station. The first copy is the line-of-sight (LoS) component and the other is a reflected component which is 20 dB weaker in terms of Power than the LoS component and delayed by 100 ns. If the signal is sufficiently wideband, causing constructive and destructive interference at different frequency points within the signal bandwidth. What will be the ratio of maximum to minimum signal level variation across bandwidth and what will be the frequency separation between two consecutive maxima or minima?

(A) 101/99, 10 MHz (B) 121/81, 10 MHz

(C) 101/99, 5 MHz (D) 121/81, 5 MHz

---

16. An antenna with an efficiency of 90% has a maximum radiation intensity of 0.5 W/Steradian. Calculate the directive gain of the antenna when the input power to the antenna when the input power to the antenna is 0.4 W

(A) 18.23 (B) 17.4 (C) 11.2 (D) 21.6

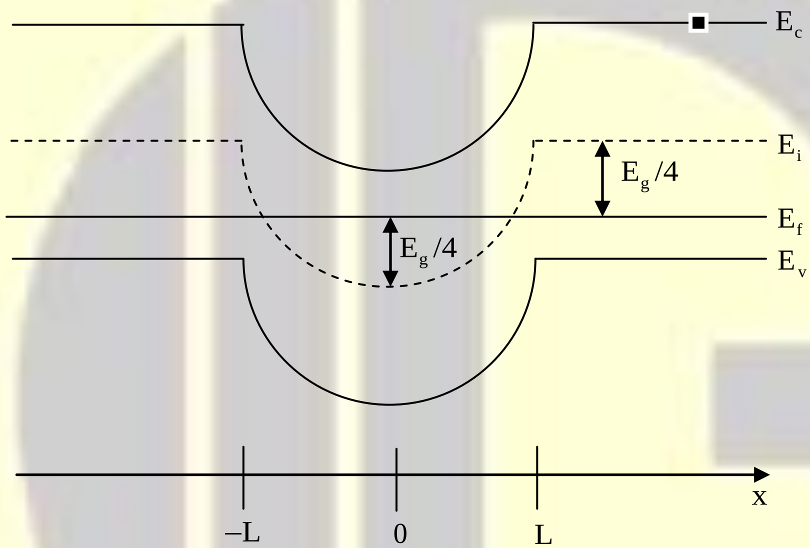
---

17. In a semiconductor device, if Fermi level (E_F) is positioned at conduction band (E_C). Determine the approximate probability of finding electrons in states at $(E_C + k_B T)$. (where k_B is Boltzmann constant and T is device temperature in Kelvin).

(A) 0.18 (B) 0.27 (C) 0.38 (D) 0.52

---

18. For the following energy band diagram, determine the approximate resistivity for $x > L$ portion of semiconductor. $E_g = 1.12\text{eV}, T = 300\text{K}, \mu_n = 600\text{cm}^2/\text{Vs}, \mu_p = 400\text{cm}^2/\text{Vs}, n_i = 10^{10}/\text{cm}^3$



(A) 11.00Ωcm (B) 15.75Ωcm (C) 23Ωcm (D) 31.25Ωcm

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19. The radiation intensity of a given antenna is U = 2(sinθ sinφ) in the range $0 \le \theta \le \pi$ and $0 \le \varphi \le \pi$ and 0 elsewhere. The directivity is

(A) 3 dB (B) 6 dB (C) 8 dB (D) 9 dB

---

20. Which of the following is an example of oversampling ADC architecture?

(A) Sigma delta (B) Successive approximation

(C) Integrator (D) Flash

---

21. A radar receiver has a detection SNR threshold of 10 dB for a 4 MHz bandwidth signal at 300 MHz frequency. If the transmit EIRP of the radar is 40 dBW and receive G/T is 10 dB/K, what is the maximum Radar cross-section (in dB m^2) detectable at 10 km range?

(Given: $10\log(4\pi)=11,\ 10\log(k_B)=-228.6, k_B$ is Boltzmann constant).

(A) $-15.6\ \text{dB m}^2$ (B) $-12.6\ \text{dB m}^2$ (C) $-9.6\ \text{dB m}^2$ (D) $-5.6\ \text{dB m}^2$

---

22. A source generates four messages m1, m2, m3 and m4 with probabilities 0.5, 0.25, 0.125 and 0.125 respectively. The messages are generated independently of each other. A source coder assigns binary code to each message. Which of the following codes has minimum average length is also uniquely decodable (sequence as per m1, m2, m3, m4)?

(A) 00, 01, 10, 11 (B) 0, 1, 10, 11

(C) 110, 111, 10, 0 (D) 0, 10, 110, 111

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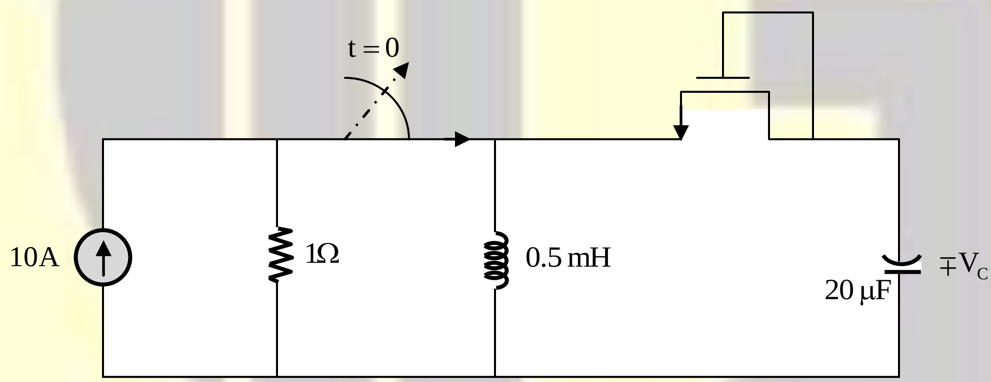
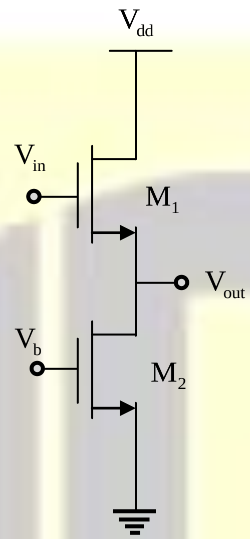
23. For the given circuit, switch remains closed for a long time and opens at t = 0 seconds. Assuming ideal model for every device, find steady state magnitude of voltage at capacitor.



(A) 1 (B) 25 (C) 50 (D) 100

---

24. For the given circuit, aspect ratio of M_1 transistor is $20/0.5, I_{D_1} = 200\mu A, V_{THO} = 0.6V, 2\phi_F = 0.81V,$ $\gamma = 0.4V^2$ and $\mu_n C_{ox} = 59.5\mu A/V^2$ .If $V_{in} = 1.2V$, find the minimum value of aspect ratio of M_2 transistor to remain saturated. ($\sqrt{10} = 3.16$)



(A) 92 (B) 195 (C) 280 (D) 560

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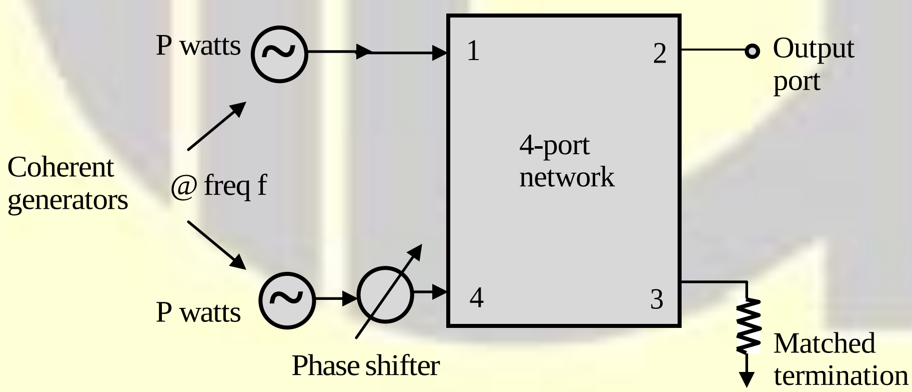
25. Two coherent microwave power sources of same frequency f, each generating P Watts of average power, are combined using a four port network in the following manner:



If the S-parameter of 4-port network are $\begin{bmatrix} 0 & \frac{j}{\sqrt{2}} & \frac{-1}{\sqrt{2}} & 0 \\ \frac{j}{\sqrt{2}} & 0 & 0 & \frac{-1}{\sqrt{2}} \\ \frac{-1}{\sqrt{2}} & 0 & 0 & \frac{j}{\sqrt{2}} \\ 0 & \frac{-1}{\sqrt{2}} & \frac{j}{\sqrt{2}} & 0 \end{bmatrix}$, what should be the phase difference between the inputs to maximize the output at port 2 and what is the maximum power?

(A) $90°, 2P$ (B) $90°, \sqrt{2}P$ (C) $45°, 2P$ (D) $45°, \sqrt{2}P$

---

26. Which of the following statement is wrong?

(A) $(100.64)_8 = (1000000000.1101)_2$

(B) $(512.512) = (4022.224)_5$

(C) $(2202)_6 = (426)_{11}$

(D) $(0.23)_4 = (0.1011)_2$

---

27. Which of the following statement is correct?

(A) NAND and NOR functions are Commutative and Associated

(B) Both NAND and NOR functions are neither Commutative nor Associative

(C) NAND and NOR functions are Associative but Commutative

(D) NAND and NOR functions are Commutative but not Associative

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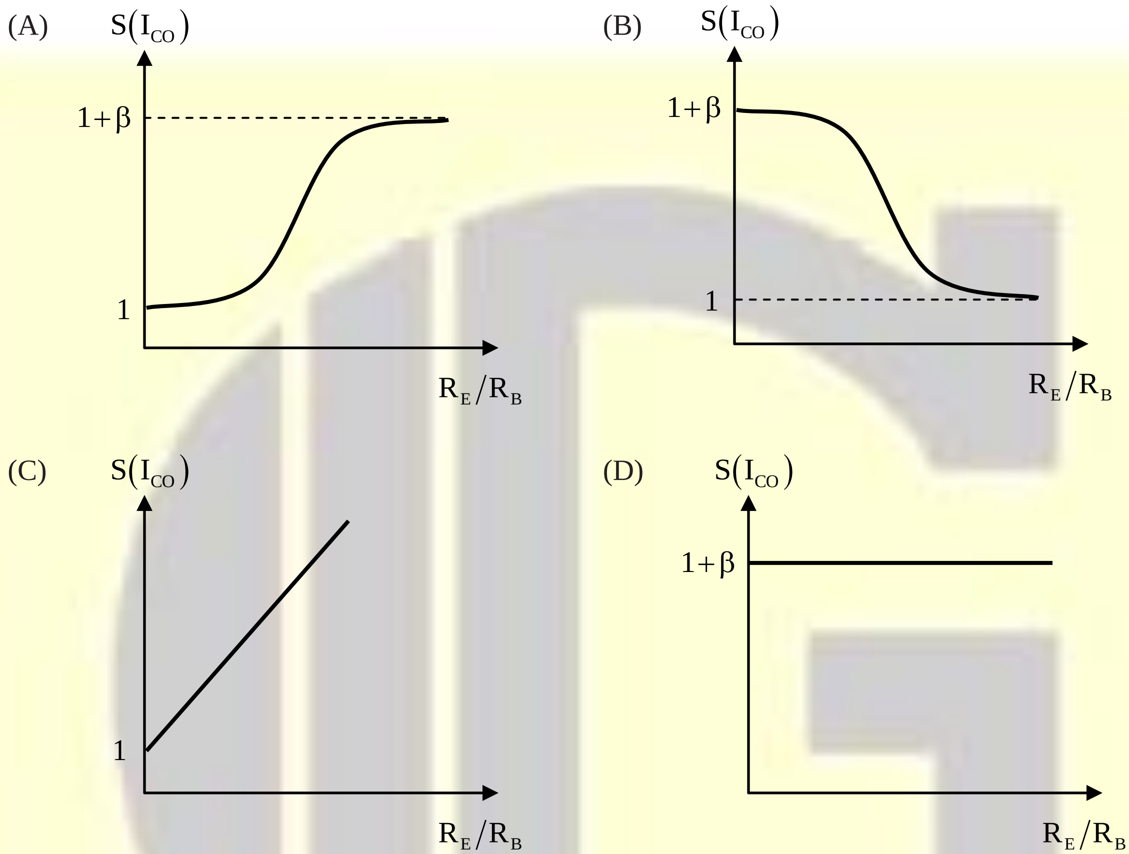
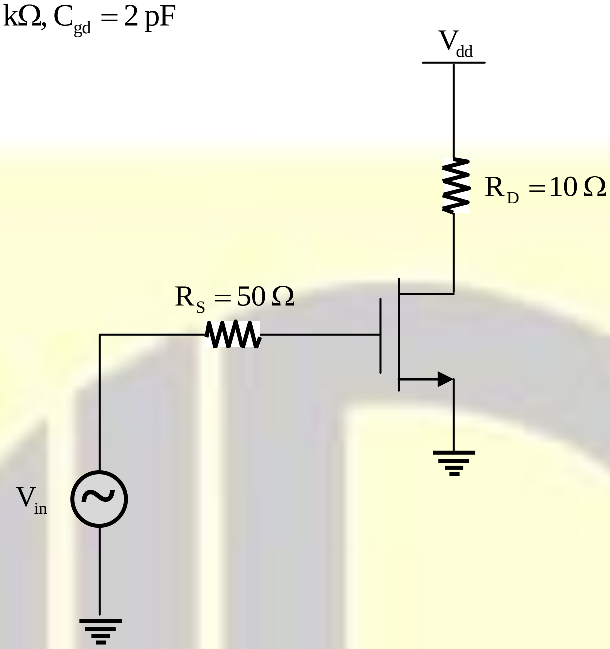
28. Which one plot gives the closed resemblance to the stability $S(I_{CO})$ of emitter bias configuration of BJT with respect to $\frac{R_E}{R_B}$? (R_E is emitter resistance and RB is base resistance)



29. For the given amplifier circuit, find the input cut-off frequency. FET parameters are $g_m = 4\,\text{mA/V}$, $C_{gs} = 4\,\text{pF}, r_{ds} = 40\,\text{k}\Omega, C_{gd} = 2\,\text{pF}$



(A) 35.5 MHz (B) 45.5 MHz (C) 90.5 MHz (D) 10.5 MHz

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30. Which of the following digital devices requires an external refresh circuit?

(A) FLASH Memory (B) E^2PROM

(C) SRAM (D) DRAM

---

31. What would be the maximum operating frequency of Mod-8 counter constructed with JK flip flops, having propagation delay of 8 ns?

(A) 16.525 MHz (B) 15.625 MHz

(C) 25.625 MHz (D) 18.525 MHz

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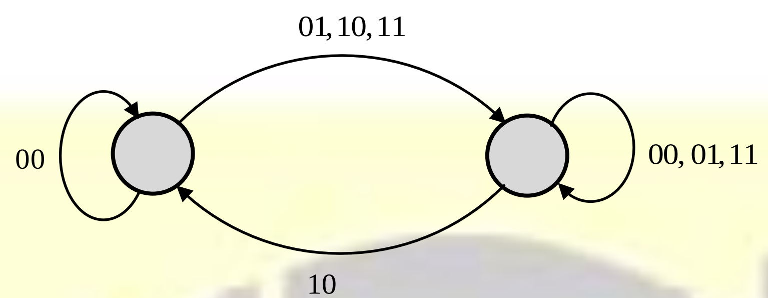
32. The following state diagram represents which of the input equation. (Given $D_A = [A, x, y]$) (Where D_A denotes a DFF with output. The x and y are the inputs to the circuit)



(A) $D_A = A \oplus x \oplus y$
(B) $D_A = A + x \oplus y$
(C) $D_A = A \oplus x + y$
(D) $D_A = A + x + y$

33. Which of the following logic circuits do not have no-change condition?

(A) D-FF
(B) T-FF
(C) JK-FF
(D) SR-latch

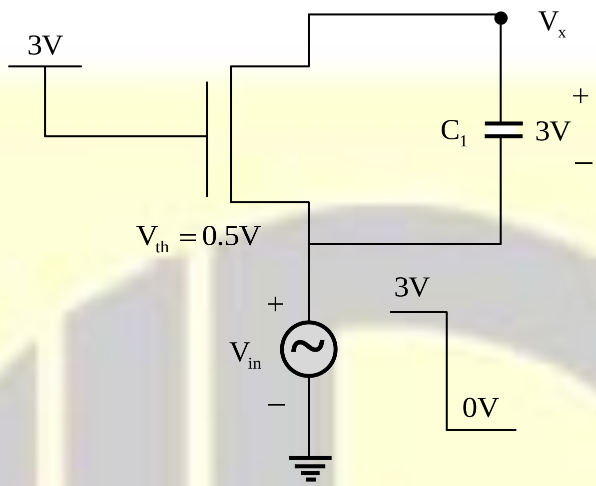
34. In VHDL, following statement is written a process, where Clock frequency is 24 MHz.

If (clock' event and clock = '1') then
counter_4bit <= counter_4bit + x "1";
End if;

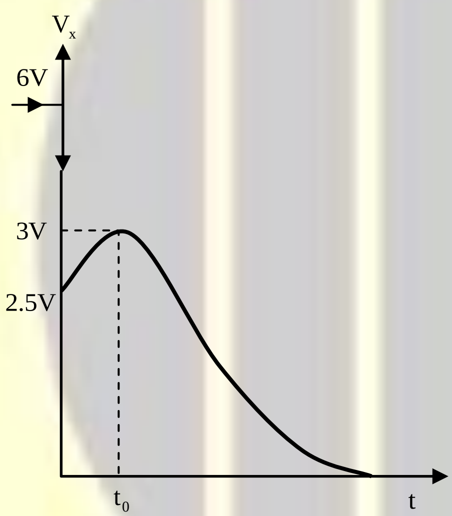
The frequency of counter_4bit (2) will be:

(A) 12 MHz
(B) 4 MHz
(C) 6 MHz
(D) 3 MHz

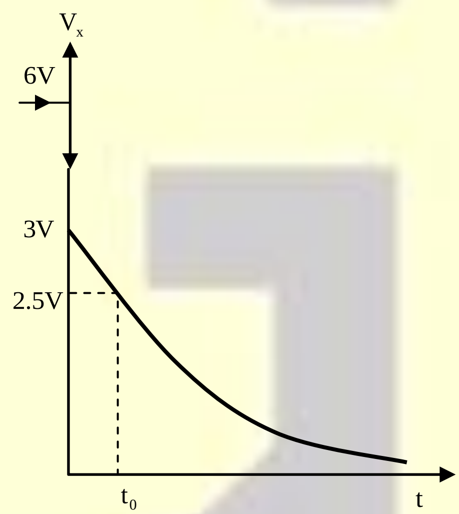
35. Initial voltage of C_1 capacitance is 3 V in the given circuit. Correct sketch of V_x as a function of time is. (Threshold voltage $(V_{th}) = 0.5V$)



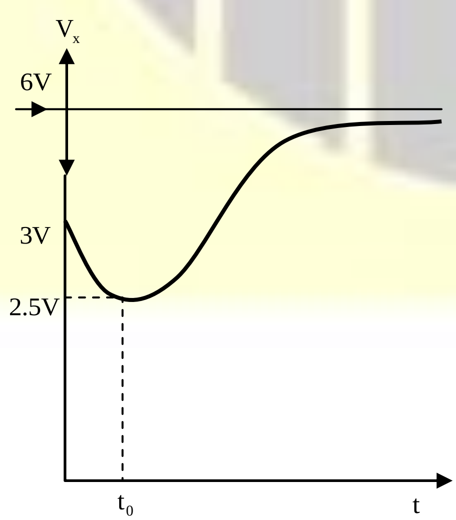
(A)



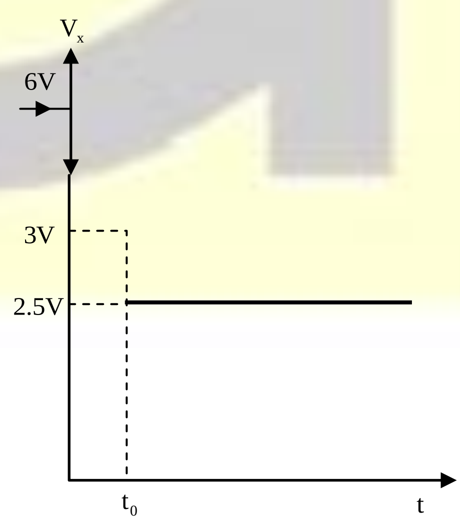
(B)



(C)



(D)



36. An SRAM has address lines from A_0 to A_{19} and data width from D_0 to D_{15}. Total capacity of the SRAM will be

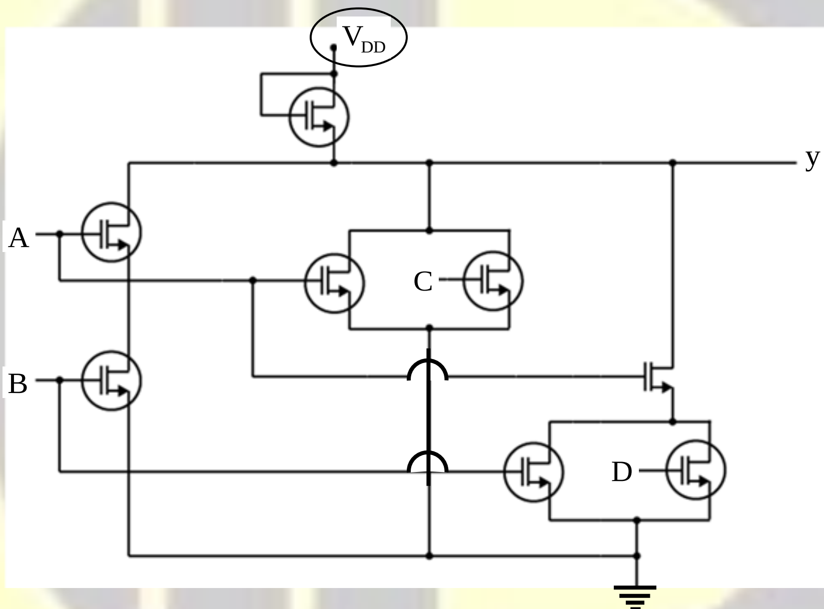
(A) 20 MB (B) 16 MB (C) 8 MB (D) 4 MB

37. Which of the following digital integrated circuit cannot be used as wired logic connections?

(A) Totem-pole TTL gate (B) Open collector TTL gate

(C) Totem-pole output with 3-state gate (D) Emitter Coupled Logic

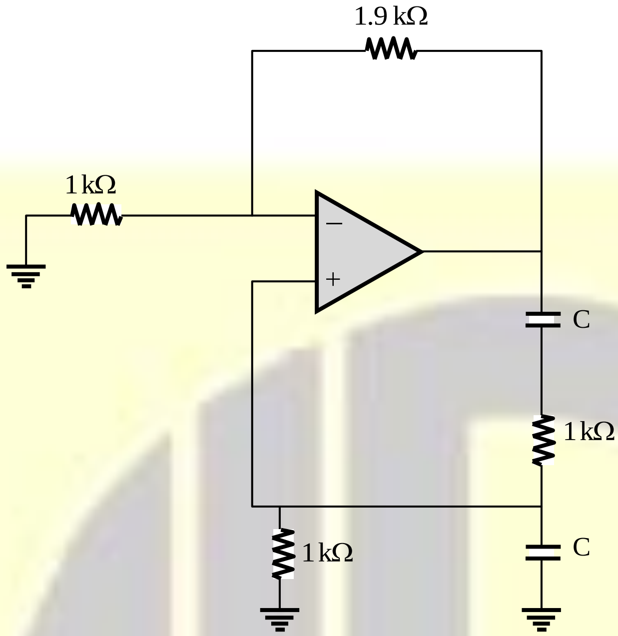
38. The logic function implemented by following circuit can be represented as



(A) $Y = \overline{\left[(AB)+(B+C)+(B+D)\right]}$ (B) $Y = \overline{\left[(AB)+(A+C)+(B+D)\right]}$

(C) $Y = \left[\overline{(AB)}+\overline{(A+C)}+\overline{(AB+D)}\right]$ (D) $Y = \overline{\left[(AB)+(A+C)+(AD)\right]}$

39. The value of C required for sinusoidal oscillation of frequency = 2 kHz in the given circuit is



(A) $\frac{1}{2\pi}\mu F$ (B) $\frac{1}{(4\pi)}\mu F$ (C) $\frac{1}{\pi}\mu F$ (D) None of these

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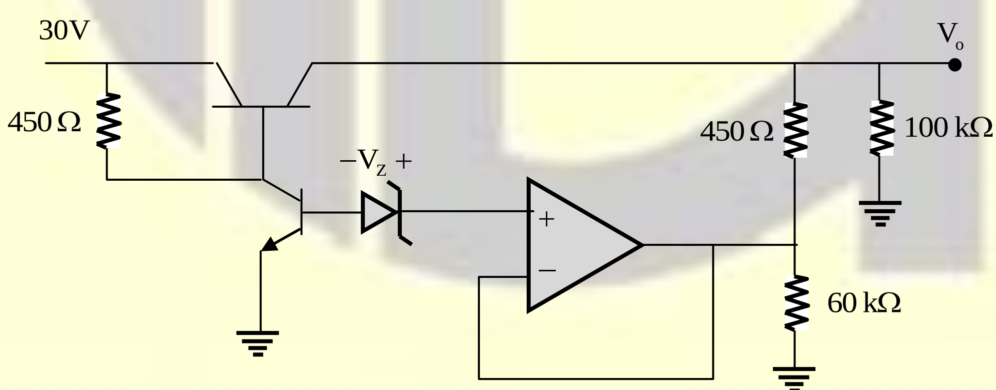
40. In the given circuit, $V_{be} = 0.7V, V_Z = 5.3V, \beta = 100. V_0$ is



(A) 5V (B) 10V (C) 15V (D) 20V

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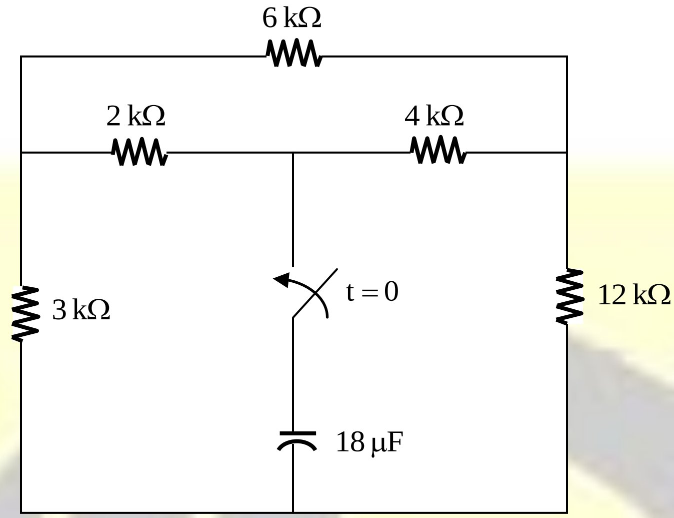
41. A $18\,\mu F$ capacitor holding charge of Q coulomb is connected to the circuit at time t = 0 sec.



The time at which the capacitor will be discharged to approximately Q/2.72 coulombs.

(A) 68 ms (B) 34 ms (C) 17 ms (D) 2.72 ms

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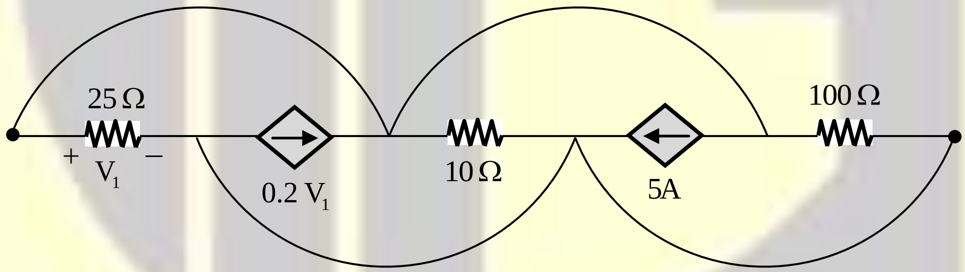
42. Determine the value of voltage V_1 in the figure shown below.



The value of voltage V_1 in volts is

(A) 100 V (B) 14.28 V (C) 50 V (D) 68.25 V

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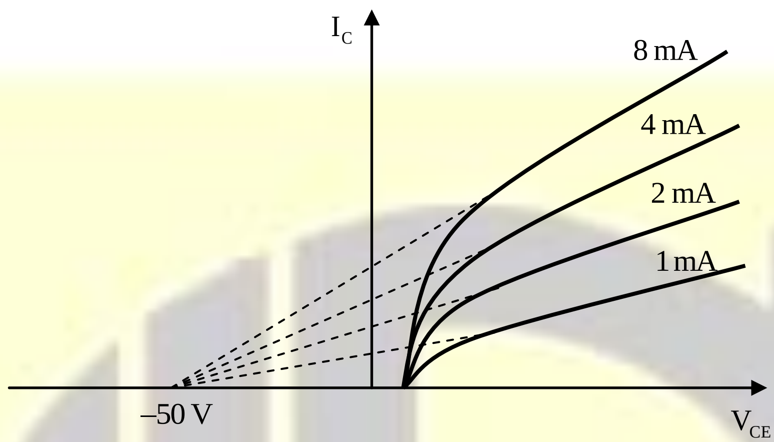
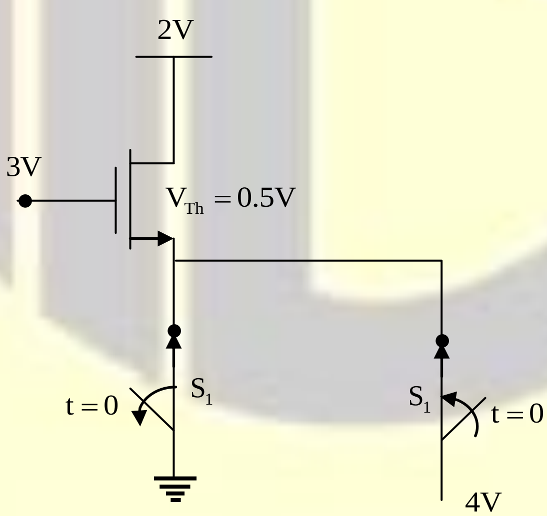
43. Output characteristics of a BJT amplifier is given. Find the minimum collector current required for $r_0 = 50\ k\Omega$. (r_0 is output resistance)



(A) 1 mA (B) 5 mA (C) 10 mA (D) 100 mA

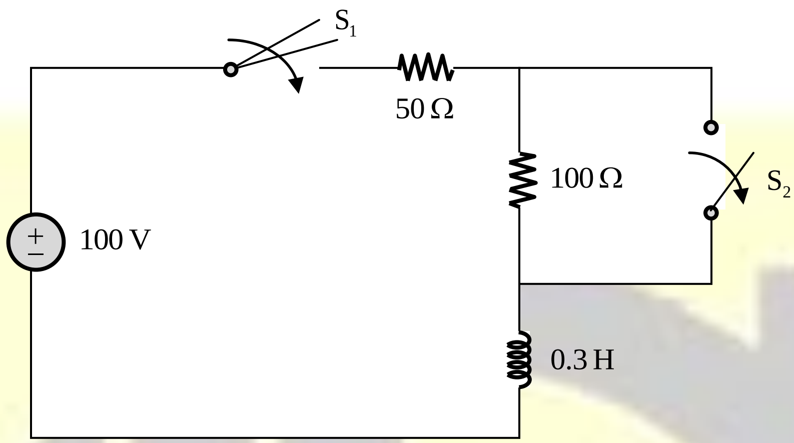
44. In the given circuits, S_1 switch remains closed and S_2 remains open for the long time. At t = 0, S_1 opens and S_2 closes and remain in this position for the long time. Find drain current for t < 0 and t >> 0 respectively if, $\mu_n C_{ox} = 100\ \mu A/V^2$ and Aspect ratio = 2



(A) $600\ \mu A, 0\ \mu A$ (B) $600\ \mu A, 25\ \mu A$

(C) $600\ \mu A, -25\ \mu A$ (D) $0\ \mu A, 600\ \mu A$

45. In the circuit shown below, switch S_1 is closed at t = 0 seconds. Switch S_2 is opened at t = 0 seconds.



The current flowing through the inductor of 0.3 H at t = 8 milli seconds is

(A) 0.65 mA (B) 0.32 mA (C) 0.26 mA (D) 0.18 mA

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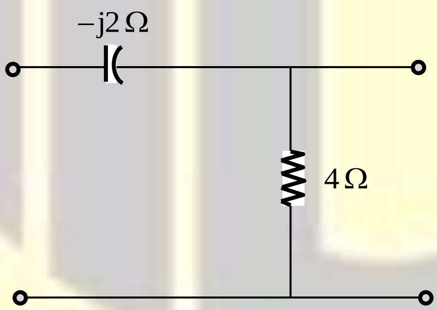
46. The transmission parameters of the network given in the following figure are represented in the matrix form as

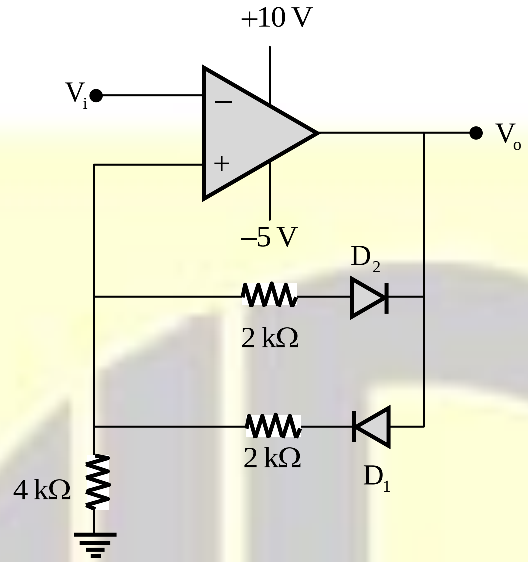
$$|T| = \begin{bmatrix} A & B \\ C & D \end{bmatrix}$$



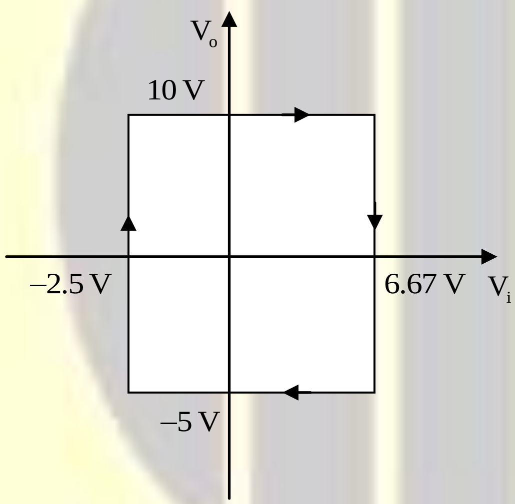
Calculate the Transmission parameter B of [T] matrix.

(A) $j2\Omega$ (B) $-j2\Omega$ (C) $(-j2+4)\Omega$ (D) 4Ω

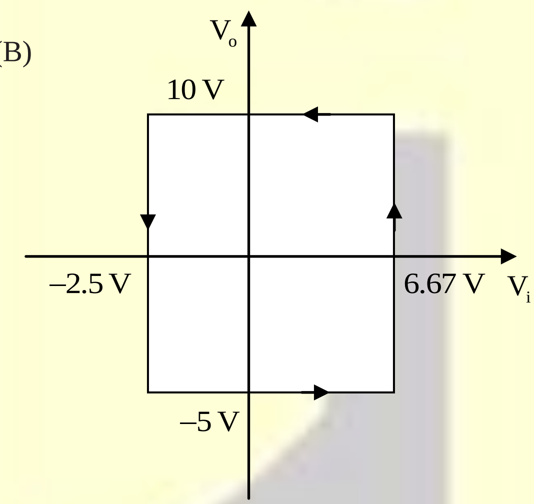
47. In the circuit shown, diodes are ideal. Which is the correct representation of transfer characteristics of the circuit?



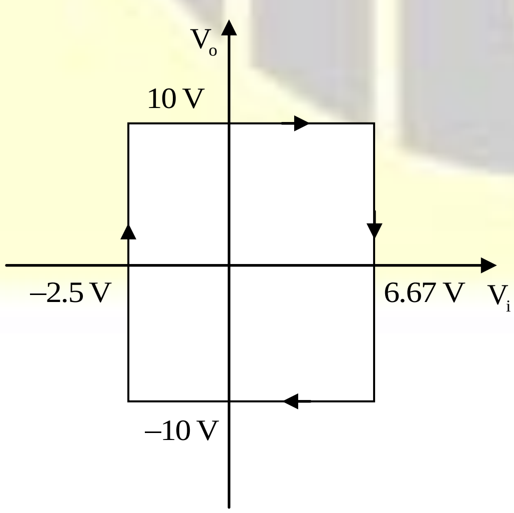
(A)



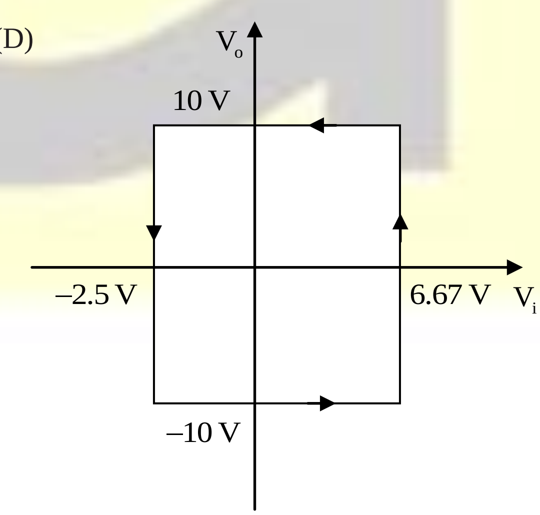
(B)



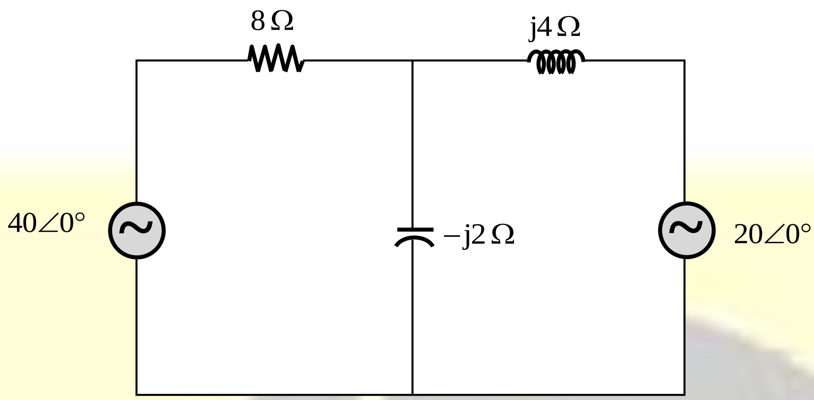
(C)



(D)



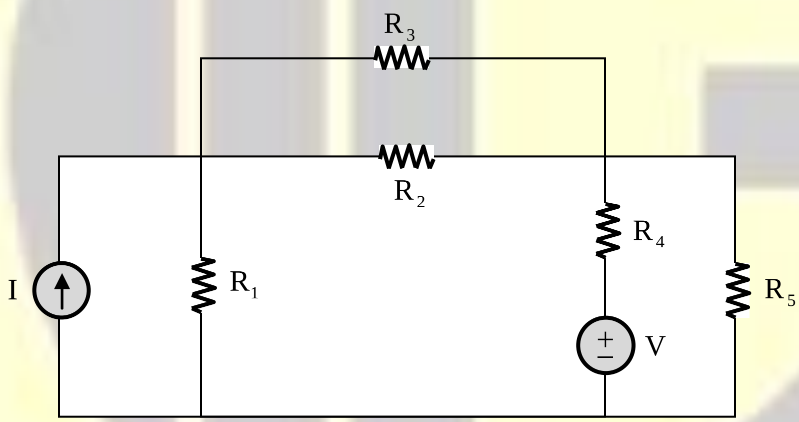
48. Consider the R-L-C network shown below,



The average power absorbed by the inductor in Watts is

(A) 40 (B) 15 (C) 0 (D) 5

49. The total number of possible trees corresponding to the network shown in the following figure is



(A) 9 (B) 5 (C) 8 (D) 7

50. For an n-type Ge specimen, width = 4 mm, length = 1 mm, current (along the length of specimen) = 1 mA, magnetic field (perpendicular to the current flow direction) = 0.1 Wb/m^2 and Hall voltage magnitude = 0.005 V. Calculate the majority carriers density.

(A) $3\times10^{19}\ cm^{-3}$ (B) $3\times10^{19}\ m^{-3}$ (C) $6\times10^{19}\ cm^{-3}$ (D) $6\times10^{19}\ m^{-3}$

51. The following table gives the forward characteristics of a Si diode. Estimate the temperature of a diode junction. (Given: ln(0.2) = –1.609)

$V_f\,(V)$	$I_f\,(mA)$
0.6	1
0.65	5

(A) 240 K (B) 360 K (C) 400 K (D) 470 K

52. An n-channel MOS transistor is made on a p-type substrate with $N_a = 10^{15}\,cm^{-3}$. Find approximate depletion charge per unit area (Q_d) at strong inversion.

$\{\ell n(10) = 2.3, \sqrt{0.046} = 0.215, n_i = 10^{10}\,cm^3\}$

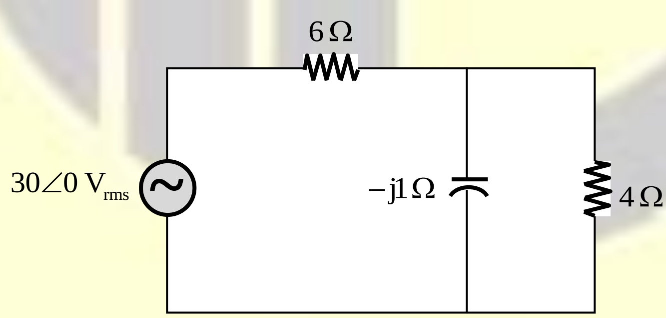
(A) $-6.9\times10^{8}\ C/cm^2$ (B) $6.9\times10^{-8}\ C/cm^2$

(C) $-3.4\times10^{-8}\ C/cm^2$ (D) $3.4\times10^{-8}\ C/cm^2$

53. For a p-channel Si JFET, $N_a = 3\times10^{16}\,cm^{-3}, N_d = 10^{18}\,cm^{-3}$. Channel thickness dimension is $a = 0.33\,\mu m$. Find approximate pinch-off voltage V_p. $\{n_i = 10^{10}\,cm^{-3}, V_T = 26\,mV, \ell n(3) = 1.098\}$

(A) 2.5 V (B) 1.7 V (C) 4.2 V (D) 3.6 V

54. Consider the circuit shown in the following figure

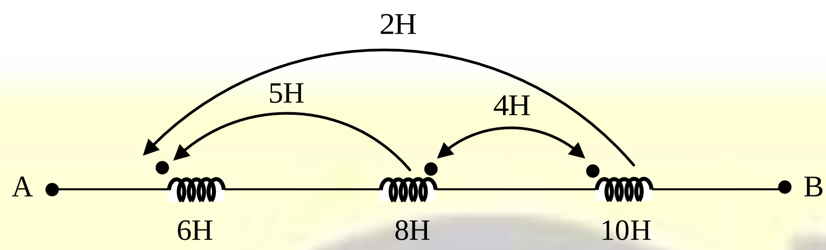


The power factor of the above circuit as seen by the source is

(A) 0.988 Lag (B) 0.988 Lead

(C) 0.235 Lag (D) 0.235 Lead

55. All the three inductors are perfectly coupled as shown in the figure, the value of total inductance (in Henry) across the terminal AB is



(A) 46 (B) 38 (C) 12 (D) 10

---

56. For a uniformly doped npn transistor, find the approximate emitter injection efficiency.

Given that:

$N_E = 2\times10^{18}\,cm^{-3}, N_B = 10^{17}\,cm^{-3}, N_C = 4\times10^{19}\,cm^{-3}, D_E = 8\,cm^2/s, D_C = 28\,cm^2/s, D_B = 20\,cm^2/s,$
$x_E = 0.5\,\mu m, x_B = 0.3\,\mu m.$

(A) 0.95 (B) 0.92 (C) 0.99 (D) 0.94

---

57. In a long p-type Si-bar with cross-sectional area $= 0.5\,cm^2$ and $N_a = 2\times10^{17}\,cm^{-3}$, extra holes $= 10^{16}\,cm^{-3}$ are injected. Assume $\mu_p = 500\,cm^2/Vs$, $n_i = 10^{10}\,cm^{-3}$ and $\tau_p = 10^{-10}\,s$, find minority carrier lifetime.

(A) $10\,\mu s$ (B) $15\,\mu s$ (C) $20\,\mu s$ (D) $25\,\mu s$

---

58. In a p-type Si at 300 K and $N_a = 8\times10^{15}\,cm^{-3}$, variation of space-charge density in the semiconductor as a function of surface potential is plotted, then select the true statement for weak inversion region. Given that p_s and n_s are hole and electron concentrations at the surface.

(A) $p_s > N_a$ (B) $n_s < N_a$ and $n_s > p_s$

(C) $n_s < N_a$ and $p_s < N_a$ (D) $n_s > N_a$

---

59. In order to ensure that the output voltage of an op-amp is zero, when both its inputs are grounded

(A) internal negative feedback is used

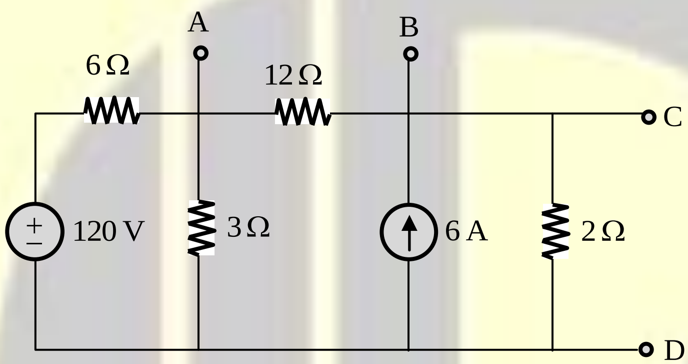
(B) an external offset balancing circuit is used at the input terminals

(C) the currents incident at the output node are carefully designed

(D) the totem-pole output transistors are designed to have exactly equal cut-in voltages

---

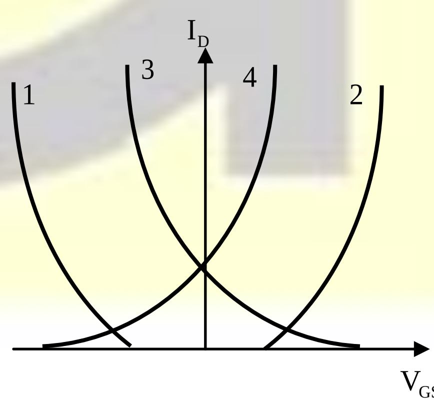
60. Consider the resistive network shown in the following figure. The value of Norton current across the terminal AB



(A) –6 A (B) 2 A (C) 7A (D) –4.5 A

---

61. The transfer characteristic of the different types of MOSFETs is shown in the following figure, where I_D is drain current and V_{GS} is the Gate-Source voltage, the correct combination of MOSFET w.r.t. to transfer characteristics is

Types of MOSFET	Transfer Characteristics
P. p-Channel Enhancement MOSFET	
Q. p-Channel Depletion MOSFET	
R. n-Channel Enhancement MOSFET	
S. n-Channel Depletion MOSFET	

(A) P-4, Q-2, R-1, S-3

(B) P-3, Q-2, R-4, S-1

(C) P-1, Q-3, R-2, S-4

(D) P-2, Q-4, R-3, S-1

62. Acceptor impurity concentration of Si at 300K is $10^{19}/cm^3$. Calculate the concentration of donor impurity atoms that must be added so that Si is n-type and the Fermi Energy is 26 meV below the conduction band edge. (Given: Effective density state $N_C = 2.7\times10^{19}/cm^3$ and Thermal Voltage (V_T) at 300K is 26 mV)

(A) $1.5\times10^{19}/cm^3$ (B) $3\times10^{19}/cm^3$

(C) $10^{19}/cm^3$ (D) $2\times10^{19}/cm^3$

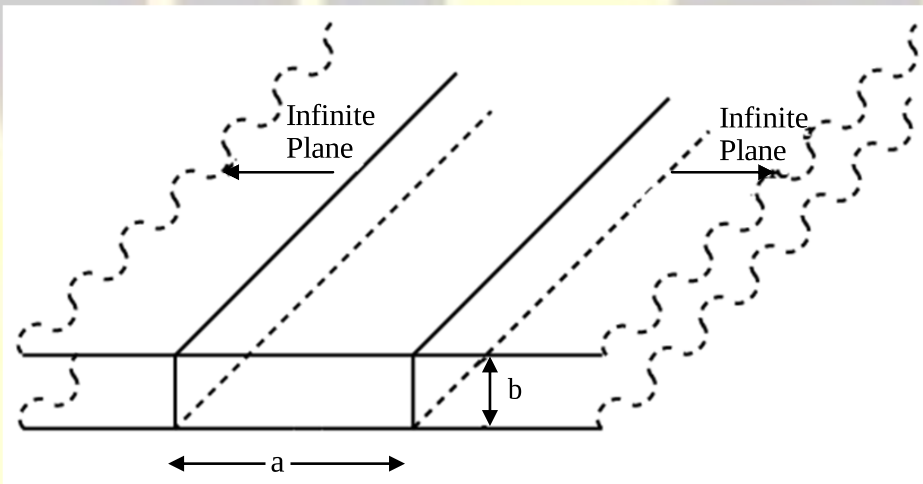
---

63. The electric field between two parallel plates placed in vacuum is 'E'. If a slab of dielectric constant $\sqrt{3}$ is inserted in between the plates such that the normal to the boundary makes an angle 45° with the lines of electric force in between the plates. Find the angle (θ) between the electric lines in the medium between the plates (vacuum) and dielectric slab.

(A) 60° (B) 15° (C) 30° (D) 25°

---

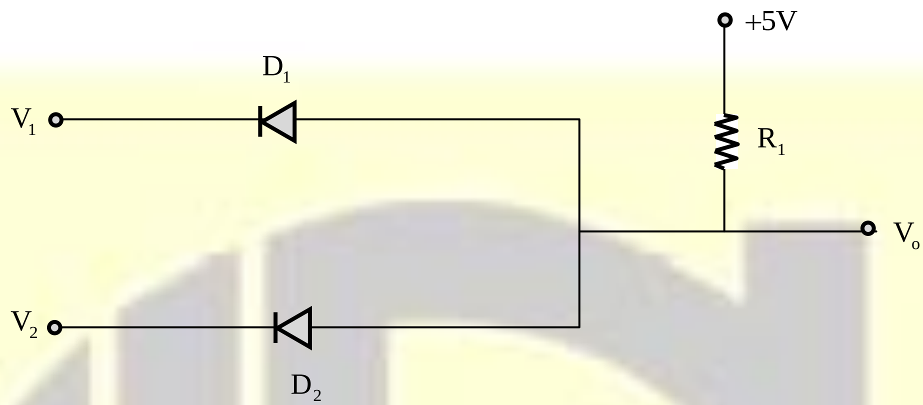
64. Two parallel perfectly conducting planes of infinite extent are placed 'b' distance apart so that the cut-off frequency of the lowest order TE mode is 15 GHz. If additionally, two perfectly conducting planes are placed 10 mm apart so as to form a rectangular waveguide as shown in figure. Find the cut-off frequency of TE_{11} mode.



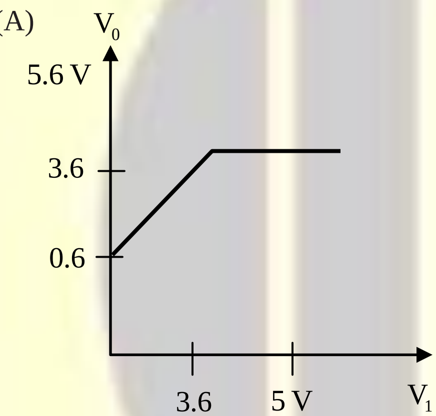
(A) 30 GHz (B) $15/\sqrt{2}$ GHz (C) $15\sqrt{2}$ GHz (D) $10\sqrt{2}$ GHz

---

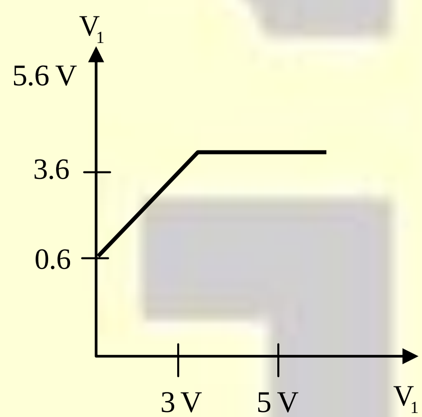
65. Consider the AND logic circuit in which $V_2 = 3V$ and V_1 lies between 0 to 5 volts. The output voltage is V_0 . The cut-in voltage of the diode D_1 and D_2 is 0.6 Volts. The output voltage V_0 versus V_1 corresponding to the below network is



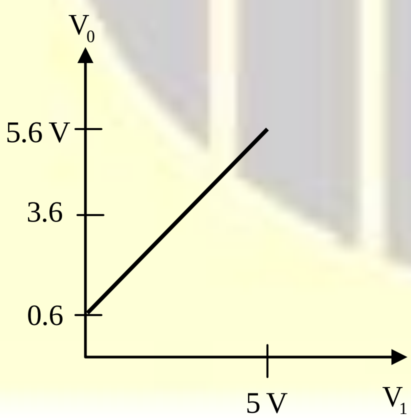
(A)



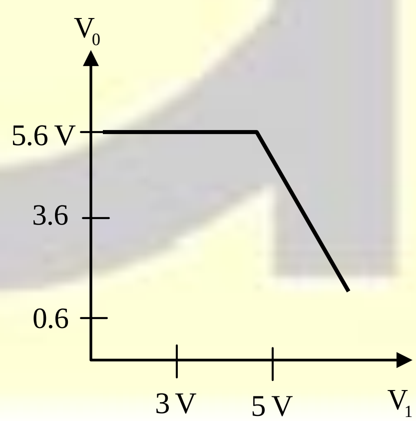
(B)



(C)



(D)



66. Following are the applications of a Buck and Boost Converters respectively

A. Regulated DC power supplies

B. Regenerative braking of DC motors

C. DC motor speed control

(A) A, B (B) B, C (C) A, C (D) B, A

---

67. In a MOSFET, SiO_2 breaks down at electric field of the order of $5\times10^6\ V/cm$. For a gate oxide of thickness 1000 Å and channel thickness of 2 μm, what is the maximum V_{GS} it can withstand?

(A) 5 V (B) 10 V (C) 100 V (D) None of the above

---

68. Which of the following is false for a Thyristor?

A. Thyristor is a majority-carrier device.

B. The forward-bias portion of Thyristor's i-v characteristics has two stable operating regions.

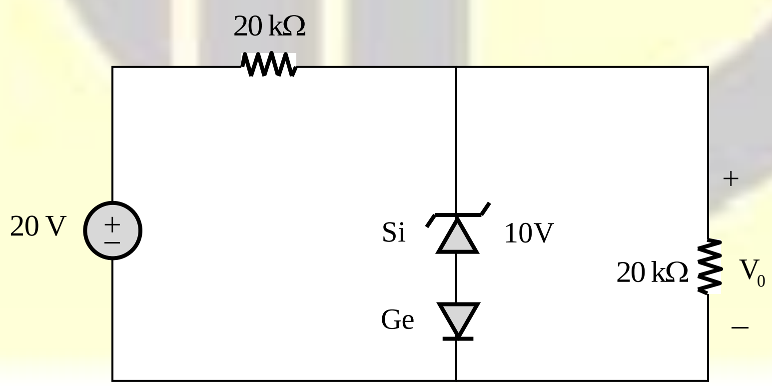
C. The forward-bias portion of Thyristor's i-v characteristic has one stable operating region.

D. The negative gate current turns off the Thyristor.

(A) A, B (B) B, C, D (C) A, C, D (D) B, C

---

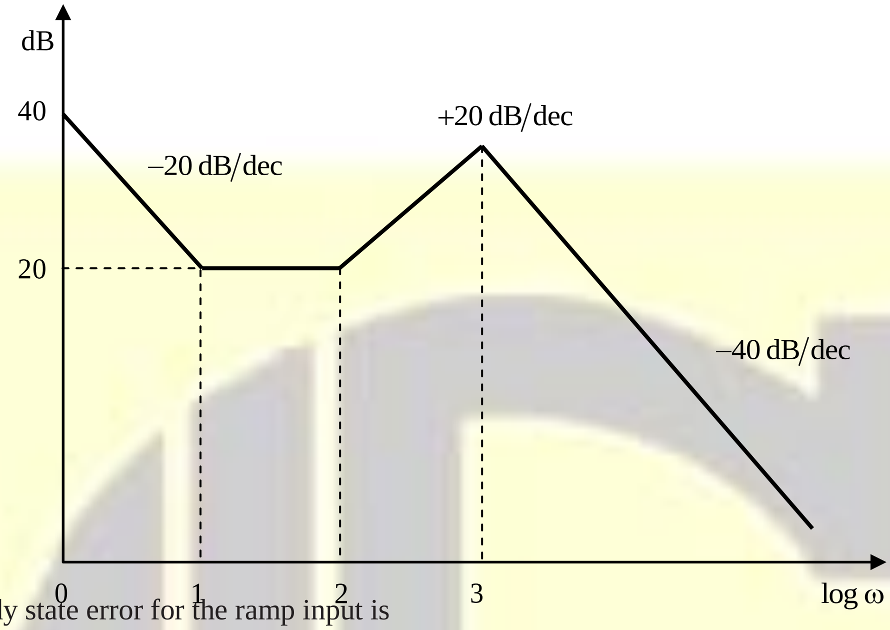
69. The Zener regulator circuit shown in the following figure consists of Si based Zener diode and Ge diode. The cut-in Voltage of Ge diode is 0.2 Volts, whereas cut-in Voltage of Si-diode is 0.7 Volts



The output voltage (V_o) of the Zener regulator circuit is

(A) 10.2 V (B) 10 V (C) 9.8 V (D) 0.2 V

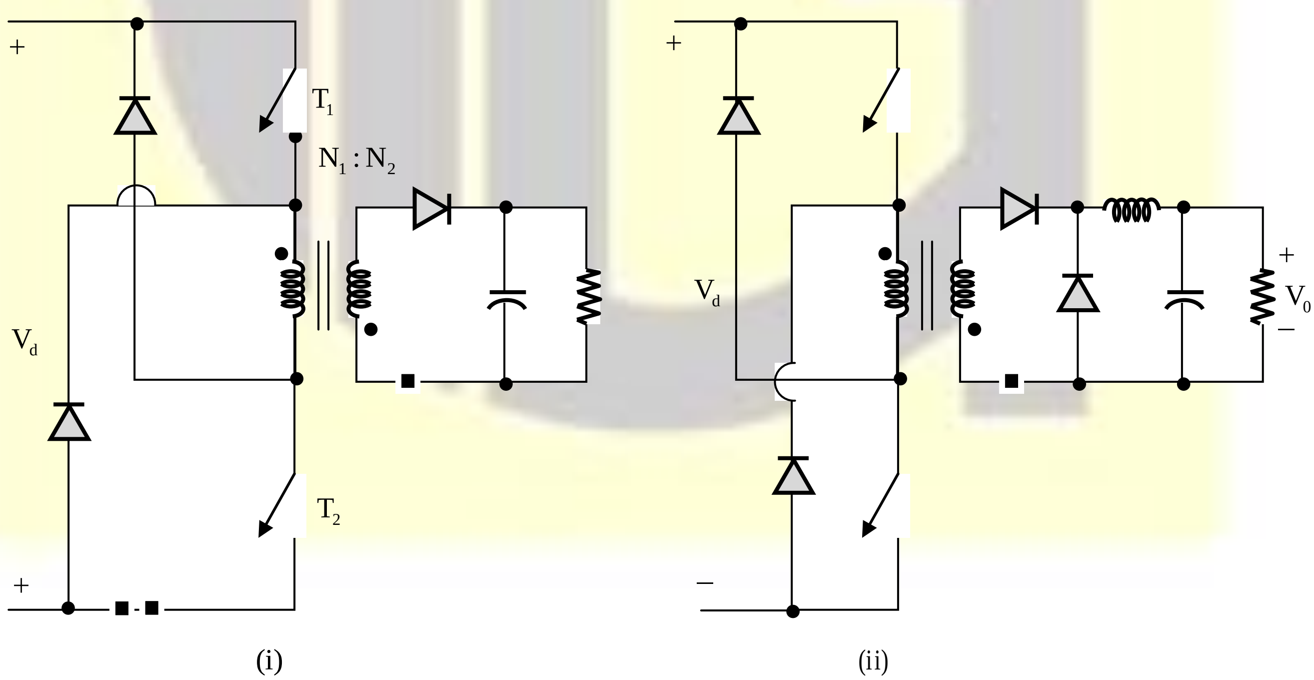
70. The asymptotic bode plot for the gain magnitude of a minimum phase system G(s) is shown in figure below.



The steady state error for the ramp input is

(A) infinite (B) 0.1 (C) 0 (D) 0.01

71. Identify the convertor topologies from the figures given below:



(A) (i) Flyback Converter
(ii) Forward Converter

(B) (i) Forward Converter
(ii) Flyback Converter

(C) Both are Forward Converters

(D) Both are Flyback Converters

---

72. Consider two control systems with following transfer function,

$$\text{System 1}: G(s) = \frac{1}{3s+1}$$

$$\text{System 2}: G(s) = \frac{1}{s+1}$$

Which of the following is true?

(A) Bandwidth of System 1 is greater than bandwidth of System 2

(B) Bandwidth of System 2 is greater than bandwidth of System 1

(C) Bandwidth of both the systems is same

(D) Both systems have infinite bandwidth

---

73. A system's open loop transfer function is given $G(s) = \frac{K}{s(s+2)(s+4)}$. If system is having a unity negative feedback, which of the following is true for such system to be stable?

(A) $K > 0$ (B) $0 < K < 24$ (C) $K < 24$ (D) None of the above

---

74. The third peak overshoot and second undershoot of the step response of the second order underdamped system is given by

(A) $e^{-\frac{3\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ and $e^{-\frac{2\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ respectively

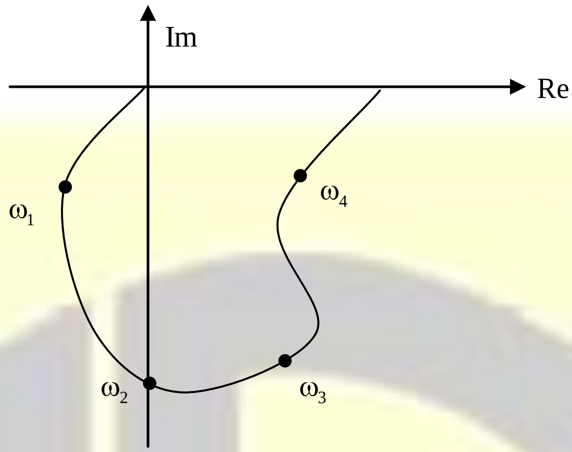
(B) $e^{-\frac{4\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ and $e^{-\frac{5\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ respectively

(C) $e^{-\frac{6\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ and $e^{-\frac{4\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ respectively

(D) $e^{-\frac{5\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ and $e^{-\frac{4\varepsilon\pi}{\sqrt{1-\varepsilon^2}}}$ respectively

---

75. Consider the Nyquist plot of the second order underdamped system shown in the following figure.



The Resonant Frequency corresponding to the Nyquist plot is

(A) ω_1 (B) ω_2 (C) ω_3 (D) ω_4

---

76. The unit step response of a system with the transfer function $G(s)=\frac{1-s}{1+s}$ is given by which of the following? (A unit step function is represented by u(t)).

(A) $\left(1-2e^{-t}\right)u(t)$

(B) $\left(1-e^{-t}\right)u(t)$

(C) $e^{-t}u(t)$

(D) $2e^{-t}u(t)$

---

77. The system $\frac{1600}{s(s+1)(s+16)}$ is to be compensated such that its gain-crossover frequency becomes same as its uncompensated Phase-crossover frequency. Which of the following is the phase crossover frequency of the compensated system?

(A) 4 rad/sec (B) 8 rad/sec (C) 16 rad/sec (D) None of the above

---

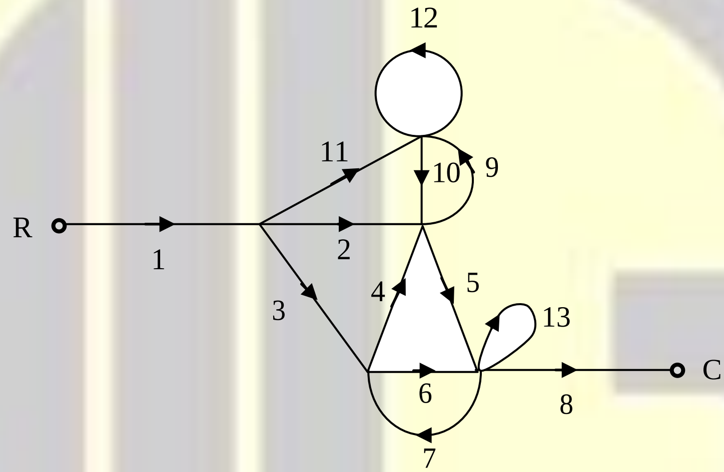
78. A discrete time, linear time invariant system with input sequence x_n and output sequence y_n is characterised by

$$y_n = 0.1x_n + 0.9\,y_{n-1}$$

If two such systems are connected in series, which of the following is the governing difference equation of the overall system?

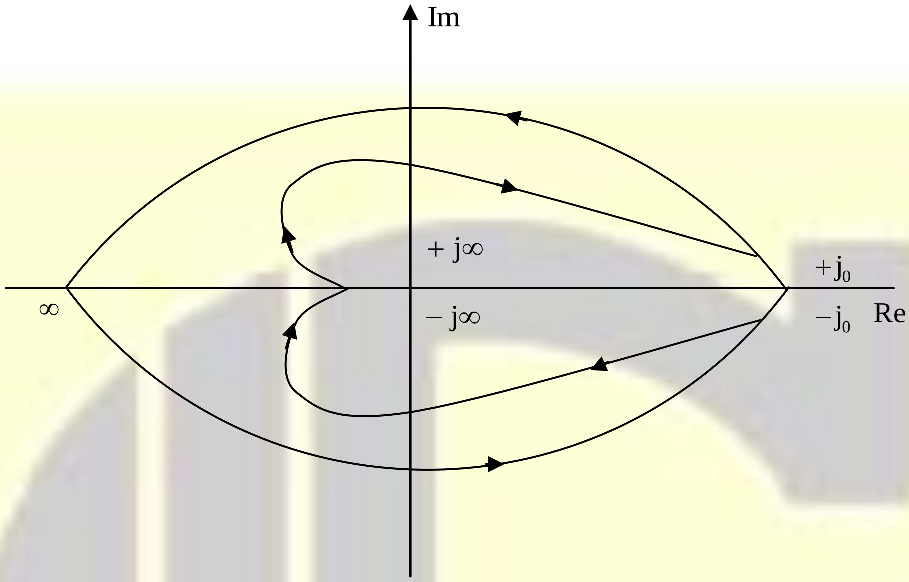
(A) $y_n - 1.8y_{n-1} + 0.81y_{n-2} = 0.01x_n$
(B) $y_n + 0.81y_{n-1} = 0.01x_n$
(C) $y_n - 0.81y_{n-1} + 1.8y_{n-2} = 0.01x_n$
(D) $y_n - 1.8y_{n-1} = 0.01x_n$

79. The total number of feedback loops of the signal flow graph is, where R is input and C is output



(A) 3
(B) 4
(C) 5
(D) 6

80. From the below given Nyquist plot, calculate the number of open loop poles on the right hand side of s-plane for the closed loop system to be stable



(A) 1 (B) 2 (C) 0 (D) –1