Andhra Pradesh State Council of Higher Education

Notations :

1.Options shown in green color and with ✓ icon are correct.

2.Options shown in red color and with ✗ icon are incorrect.

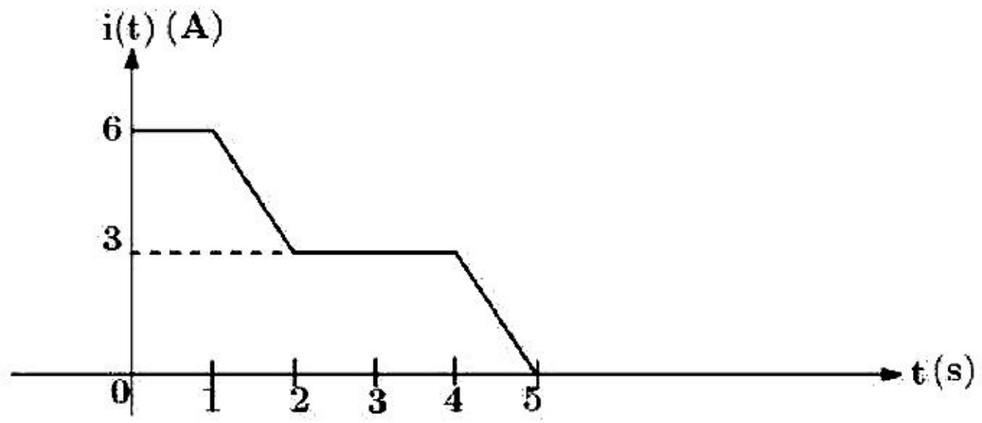
Question Paper Name :	Electronics and Communication Engineering 19th July 2022 Shift 1
Duration :	120
Total Marks :	120
Display Marks:	No
Share Answer Key With Delivery Engine :	Yes
Calculator :	None
Magnifying Glass Required? :	No
Ruler Required? :	No
Eraser Required? :	No
Scratch Pad Required? :	No
Rough Sketch/Notepad Required? :	No
Protractor Required? :	No
Show Watermark on Console? :	Yes
Highlighter :	No
Auto Save on Console?	Yes
Change Font Color :	No
Change Background Color :	No
Change Theme :	No
Help Button :	No
Show Reports :	No
Show Progress Bar :	No
Is this Group for Examiner? :	No
Examiner permission :	Cant View
Show Progress Bar? :	No

Electronics and Communication Engineering

Section Id :	90030011
Section Number :	1
Mandatory or Optional :	Mandatory
Number of Questions :	120
Section Marks :	120
Enable Mark as Answered Mark for Review and Clear Response :	Yes
Maximum Instruction Time :	0

Question Number : 1 Question Id : 9003001201 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the time-varying current through a network element is as shown in the Figure. The total charge passed through the network element at $t = 5$ second is --------.



Options :

1. ✖ 12 coulombs

2. ✔ 16 coulombs

3. ✖ 18 coulombs

4. ✖ 20 coulombs

Question Number : 2 Question Id : 9003001202 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A two-port network is described by the following:

$$V_1 = I_1 + 2\,V_2,$$

$$I_2 = -2\,I_1 + 0.9\,V_2\,.$$

The determinant value of the h −parameter matrix is ----------.

Options :

1. ✗ 2.9

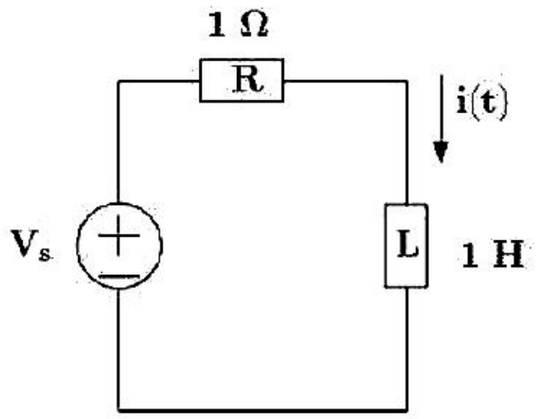
2. ✗ 3.9

3. ✓ 4.9

4. ✗ 6.9

Question Number : 3 Question Id : 9003001203 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the circuit shown in the Figure. Suppose that $V_s(t) = u(t)$. Note that the unit-step signal is defined for $t > 0$. At $t = 1$, the value of $i(t)$ is ----------. (Note: The continuous-time Fourier transform and its properties are useful. The value of $e = 2.718\ldots$)



Options :

1. ✗ $\frac{1}{e}$

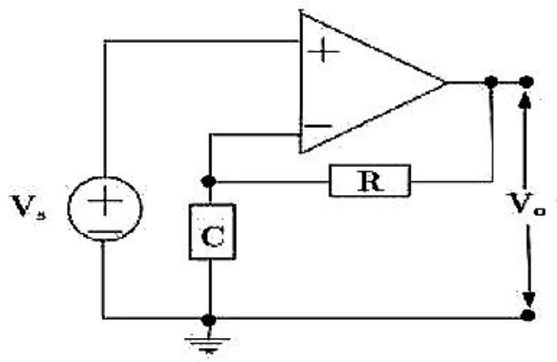
2. ✗ $1 + \left(\frac{1}{e}\right)$

3. ✓ $1 - \left(\frac{1}{e}\right)$

4. ✗ $\frac{2}{e}$

Question Number : 4 Question Id : 9003001204 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the circuit shown in the Figure. Let $R = 1\,M\Omega, C = 1\,\mu F$. The expression for $H(s) = \frac{V_o(s)}{V_s(s)}$ is given by ---------.



Options :

1. ✓ $s + 1$

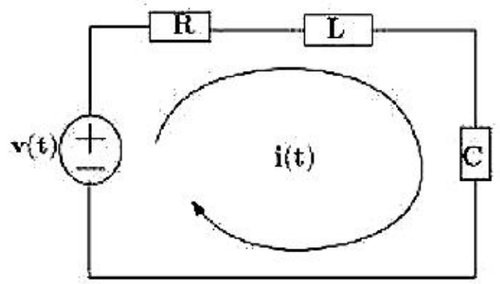
2. ✗ $\frac{1}{s+1}$

3. ✗ $\frac{1}{s}$

4. ✗ s

Question Number : 5 Question Id : 9003001205 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the circuit elements $R = 1\ K\Omega, L = 1\ H, C = 1\ \mu F$. Which of the following is a valid differential equation for the series RLC circuit shown in the Figure?



Options :

1. ✗ $\frac{dv}{dt} = \frac{d^2i}{dt^2} + \frac{di}{dt} + 10^6\, i$

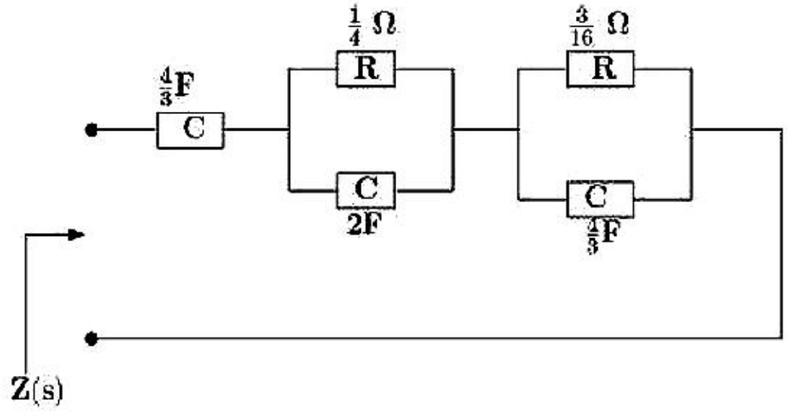
2. ✓ $\frac{dv}{dt} = \frac{d^2i}{dt^2} + 10^3 \frac{di}{dt} + 10^6\, i$

3. ✗ $\frac{dv}{dt} = 10^6\ \frac{d^2i}{dt^2} + 10^3 \frac{di}{dt} + \ i$

4. ✗ $\frac{dv}{dt} = \frac{d^2i}{dt^2} + \frac{di}{dt} + \ i$

Question Number : 6 Question Id : 9003001206 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the electric network shown in the Figure. The driving point impedance $Z(s)$ is given by ----------.



Options :

1. ✓ $\frac{2(s^2+4s+3)}{s(s+2)(s+4)}$

2. ✗ $\frac{(s^2+4s+3)}{2s(s+2)(s+4)}$

3. ✗ $\frac{(s^2+4s+3)}{s(s+2)(s+4)}$

4. ✗ $\frac{(s^2+3s+4)}{s(s+2)(s+4)}$

Question Number : 7 Question Id : 9003001207 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following is a valid and complete incidence matrix of a closed graph?

Options :

1. ✗ $\begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$

2. ✗ $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$

3. ✓ $\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$

4. ✗ $\begin{bmatrix} -1 & 1 \\ 0 & 0 \end{bmatrix}$

Question Number : 8 Question Id : 9003001208 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

In a certain network, it is found that the time−varying current is given by

$$i(t) = k_1 e^{-2t} - k_2 e^{-t}, \qquad t > 0, \qquad k_1, k_2 > 0.$$

The time−varying current $i(t)$ attains a maximum value at ----------.

Options :

1. ✗ $t = ln\left(\frac{k_1}{2k_2}\right)$

2. ✓ $t = ln\left(\frac{2k_1}{k_2}\right)$

3. ✗ $t = ln\left(\frac{k_1}{k_2}\right)$

4. ✗ $t = ln\,(k_1 k_2)$

Question Number : 9 Question Id : 9003001209 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a specific application requires a simple RC lowpass filter with the cutoff frequency $10\ KHz$. If $C = 1\ \mu F$, the value of R is ----------. (Note: $\frac{1}{2\pi} \approx 0.16.$)

Options :

1. ✗ $80\ \Omega$

2. ✗ $40\ \Omega$

3. ✗ $120\ \Omega$

4. ✓ $160\ \Omega$

Question Number : 10 Question Id : 9003001210 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the Thévenin impedance of a source is $Z_{th} = 100 + j\ 60\ \Omega$ and the peak Thévenin voltage $V_{th} = 100 + j\ 0\ V$. The maximum available average power is ----------.

Options :

1. ✓ $12.5\ W$

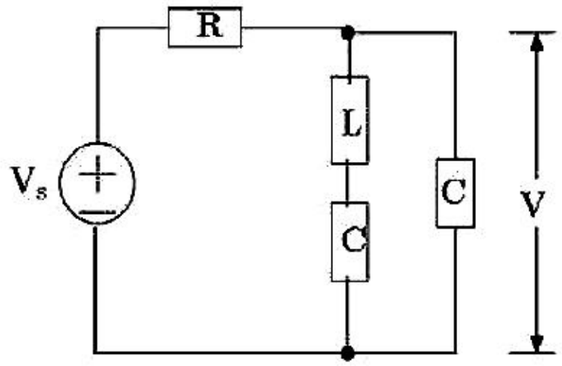
2. ✗ $25\ W$

3. ✗ $50\ W$

4. ✗ $10\ W$

Question Number : 11 Question Id : 9003001211 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the circuit shown in the Figure. Let $L = 10\ mH, C = 1\ \mu F$. The voltage V across the shunt capacitor is real when $\omega =$ ----------.



Options :

1. ✗ $100\ rad/s$

2. ✗ $1000\ rad/s$

3. ✓ $10^4\ rad/s$

4. ✗ $10^5\ rad/s$

Question Number : 12 Question Id : 9003001212 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Which of the following has the dimension of capacitance?

Options :

1. ✗ $\frac{R}{L}$

2. ✗ $\frac{R}{L^2}$

3. ✓ $\frac{L}{R^2}$

4. ✗ $\frac{L}{R}$

Question Number : 13 Question Id : 9003001213 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The dynamics of an electric system is represented by the following vector-matrix differential equation:

$\dot{X} = AX + Bu,\ y = CX$, where A $= \begin{bmatrix} -10^3 & -10^3 \\ 10^6 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 10^3 \\ 0 \end{bmatrix}$, and $C = [0 \quad 1]$.

Options :

1. ✓ $s^2 + 10^3 s + 10^9 = 0$

2. ✗ $s^2 + 10^3 s + 10^6 = 0$

3. ✗ $s^2 + 10^6 s + 10^3 = 0$

4. ✗ $s^2 + 10^3 s + 10^3 = 0$

Question Number : 14 Question Id : 9003001214 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an $n-$doped Si has a hole concentration of $1.2 \times 10^{16} cm^{-3}$ and intrinsic concentration of $2.4 \times 10^{16}\ cm^{-3}$. At equilibrium, the electron concentration is approximately ----------.

Options :

1. ✗ $4.8 \times 10^{16}\ mm^{-3}$

2. ✓ $4.8 \times 10^{13}\ mm^{-3}$

3. ✗ $2.4 \times 10^{16}\ mm^{-3}$

4. ✗ $2.4 \times 10^{13}\ mm^{-3}$

Question Number : 15 Question Id : 9003001215 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let E_F denote the Fermi energy level and E_i denote intrinsic energy level. At certain constant temperature, which of the following is a valid relationship between electron intrinsic concentration n_i and electron concentration n?

Options :

1. ✗ $E_F - E_i \propto e^{\frac{n}{n_i}}$

2. ✗ $E_F - E_i \propto e^{-\frac{n}{n_i}}$

3. ✗ $E_F - E_i \propto ln\left(\frac{n_i}{n}\right)$

4. ✓ $E_F - E_i \propto ln\left(\frac{n}{n_i}\right)$

Question Number : 16 Question Id : 9003001216 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an open-circuited $p-n$ junction diode at $300°K$. Suppose that the donor atoms concentration N_D is changed by a factor of 10^3 and the acceptor atoms concentration is changed by a factor of 10. The approximate change in the contact difference of potential is ----------. (Assume $V_T = 26\ mV,\ ln\ 10 \approx 2.3.$)

Options :

1. ✗ $120\ mV$

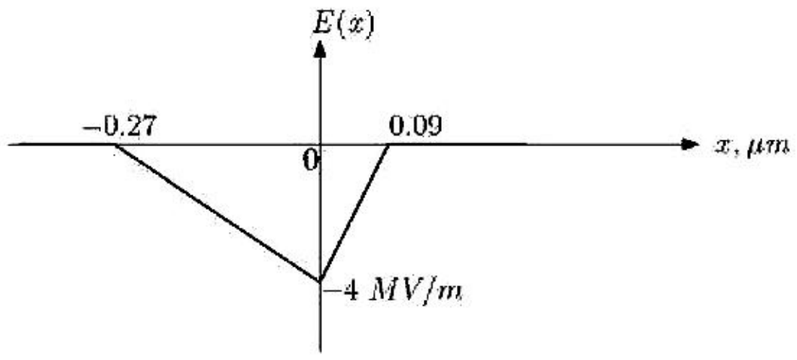
2. ✓ $240\ mV$

3. ✗ $360\ mV$

4. ✗ $60\ mV$

Question Number : 17 Question Id : 9003001217 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the Figure shown. It depicts the variation of the electric field intensity as a function of position x in a semiconductor junction. The approximate built-in voltage for the junction is ------.



Options :

1. ✗ $0.18\ V$

2. ✗ $0.36\ V$

3. ✗ $0.48\ V$

4. ✓ $0.72\ V$

Question Number : 18 Question Id : 9003001218 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The ion implantation is one of the techniques used in semiconductor IC fabrication. The technique is used to ----------.

Options :

1. ✗ deposit a metallic layer on a semiconductor

2. ✓ dope a semiconductor

3. ✗ deposit a metallic layer in an insulator

4. ✗ deposit an insulating layer on a semiconductor

Question Number : 19 Question Id : 9003001219 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an ideal metal–semiconductor junction. Let ϵ_r denote the relative dielectric constant. Let E_0 denote the electric field intensity at position $x = 0$. The depletion layer width can be expressed as ----------.

Options :

1. ✓ $\frac{\epsilon_0 \epsilon_r E_0}{qN_A}$

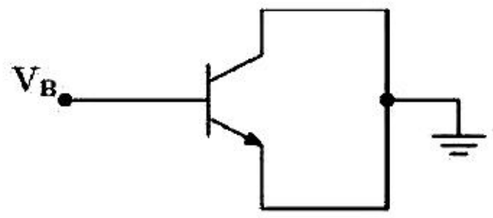
2. ✗ $\frac{qN_A}{\epsilon_0 \epsilon_r E_0}$

3. ✗ $\frac{\epsilon_0 \epsilon_r}{qN_A E_0}$

4. ✗ $\frac{\epsilon_0 \epsilon_r N_A}{qE_0}$

Question Number : 20 Question Id : 9003001220 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the BJT circuit shown in the Figure. Assume that $V_B > V_{BE,ON}$. Which of the following is true?



Options :

1. ✗ Base-Emitter junction is reverse biased; Base-Collector junction is forward biased

2. ✓ Base-Emitter junction is forward biased; Base-Collector junction is forward biased

3. ✗ Base-Emitter junction is forward biased; Base-Collector junction is reverse biased

4. ✗ Base-Emitter junction is reverse biased; Base-Collector junction is reverse biased

Question Number : 21 Question Id : 9003001221 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an MOS capacitor needs to be fabricated with an oxide thickness of W. Let the relative dielectric constant ϵ_r of silicon dioxide is 3.5. The chip area required to obtain a capacitance C is given by ----------.

Options :

1. ✓ $\frac{2CW}{7\epsilon_0}$

2. ✗ $\frac{2C^2W}{7\epsilon_0}$

3. ✗ $\frac{2CW^2}{7\epsilon_0}$

4. ✗ $\frac{2W^2}{7C\epsilon_0}$

Question Number : 22 Question Id : 9003001222 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an electron of mass m is moving with an average drift velocity v. Assuming fixed electric field intensity, the energy of the electron is ----------.

Options :

1. ✗ directly proportional to the electron mobility

2. ✓ directly proportional to the square of the electron mobility

3. ✖ directly proportional to the cube of the electron mobility

4. ✖ independent of electron mobility

Question Number : 23 Question Id : 9003001223 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the reverse saturation current of a Ge diode increases by a factor of 256 when the temperature increases from $10°C$ to $T°C$. The temperature T is equal to ----------.

Options :

1. ✖ $80°C$

2. ✖ $70°C$

3. ✔ $90°C$

4. ✖ $40°C$

Question Number : 24 Question Id : 9003001224 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the buried layer in an integrated BJT on an n −type substrate. The layer in an integrated transistor is ----------.

Options :

1. ✖ used to reduce parasitic capacitance

2. ✔ p^+ doped

3. ✖ n^+ doped

4. ✗ located in the emitter region

Question Number : 25 Question Id : 9003001225 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The Einstein relationship in semiconductor physics connects the following two quantities.

Options :

1. ✗ The hole and electron diffusion coefficients

2. ✗ The diffusion length and carrier life time

3. ✓ The mobility and the diffusion coefficients

4. ✗ The hole mobility and the electron mobility

Question Number : 26 Question Id : 9003001226 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A color LED is having a forward voltage drop of 2.1 V. The LED is connected to 5 V dc power supply. The series resistance needed to limit the forward current to 20 mA is ------. (Note: Ignore the internal resistance of the dc power supply.)

Options :

1. ✗ 290 Ω

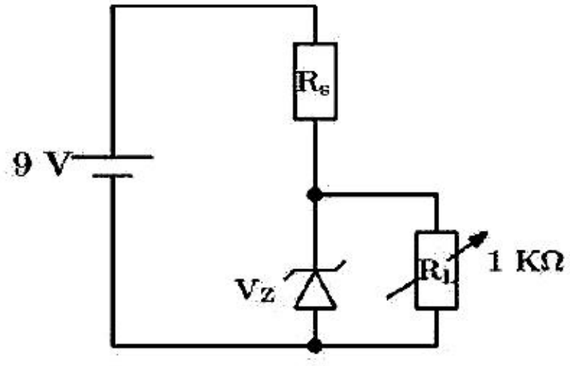
2. ✓ 145 Ω

3. ✗ 245 Ω

4. ✗ 345 Ω

Question Number : 27 Question Id : 9003001227 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the Zener diode-based voltage regulator circuit shown in the Figure. Suppose that a 5 V regulated power supply is needed to be produced from a 9 V dc input source. The maximum power rating of the Zener diode is 1.8 W. Assuming that the stable output voltage is approximately equal to V_Z, the Zener current at full load is ----------.



Options :

1. ✓ 355 mA

2. ✗ 175 mA

3. ✗ 35.5 mA

4. ✗ 17.5 mA

Question Number : 28 Question Id : 9003001228 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the standard bridge rectifier circuit made up of four $p-n$ diodes and a smoothing capacitor C. Which of the following is a valid statement?

Options :

1. ✗ The maximum ripple voltage is directly proportional to the capacitance

2. ✓ The maximum ripple voltage is inversely proportional to the capacitance

3. ✗ The ripple voltage is independent of the capacitance

4. ✗ The maximum ripple voltage is inversely proportional to square root of the capacitance

Question Number : 29 Question Id : 9003001229 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the relationship between BJT transconductance and the quiescent collector current I_C. Suppose that, for $|I_C| > |I_{CO}|$, the transconductance is approximately 0.5 mA/V. The magnitude of the quiescent collector current is ----------. (Note: $V_T = 26\ mV$.)

Options :

1. ✗ $26\ mA$

2. ✗ $2.6\ mA$

3. ✓ $13\ mA$

4. ✗ $1.3\ mA$

Question Number : 30 Question Id : 9003001230 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the transconductance parameter g_m of a JFET. Suppose that the pinchoff voltage is $-3\,V, I_{DSS} = 4\,mA$, and $I_D = 0.36\,mA$, the value of g_m is ----------.

Options :

1. ✗ $1.6\,mA/V$

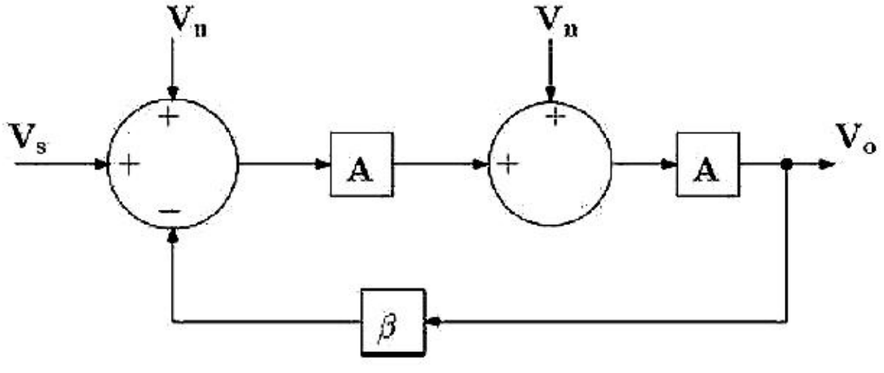
2. ✓ $0.8\,mA/V$

3. ✗ $0.4\,mA/V$

4. ✗ $2.4\,mA/V$

Question Number : 31 Question Id : 9003001231 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the block diagram for a feedback amplifier as shown in the Figure. The approximate expression for $\frac{V_o}{V_s}$ is given by ----------. (Let V_n denote noise voltage. Assume that $V_s \gg V_n$, amplification factor A is very large so that $\frac{V_n}{A} \to 0$.)



Options :

1. ✗ $\frac{A}{1+A^2\beta}$

2. ✗ $A(1 + A^2\beta)$

3. ✗ $A^2(1 + A\beta)$

4. ✓ $\frac{A^2}{1+A^2\beta}$

Question Number : 32 Question Id : 9003001232 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that three identical cascaded stages have an overall 3 −dB frequency of 27 KHz. The upper 3 −dB frequency of each stage is approximately ----------. (Note: Assume non-interacting stages. Further, $2^{1/3} \approx 1.26$.)

Options :

1. ✗ $63\ KHz$

2. ✗ $43\ KHz$

3. ✓ $53\ KHz$

4. ✗ $33\ KHz$

Question Number : 33 Question Id : 9003001233 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an operational amplifier has the slew rate $0.9\ V/\mu s$. The maximum frequency of an output sinusoid $V_0 = 10\ sin\ \omega t$ is ----------. (Note: $\frac{1}{2\pi} \approx 0.16$.)

Options :

1. ✖ $4.8\,KHz$

2. ✖ $9.6\,KHz$

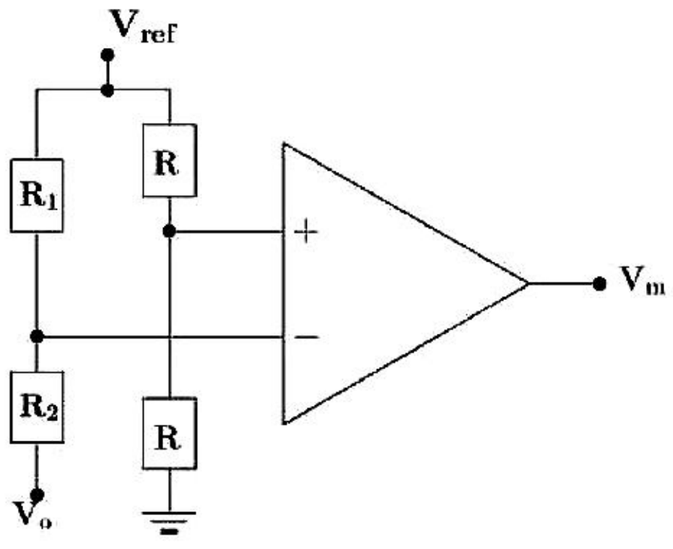
3. ✖ $28.8\,KHz$

4. ✔ $14.4\,KHz$

Question Number : 34 Question Id : 9003001234 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the operational amplifier circuit shown in the Figure. Consider the following: $R_2 = \frac{R_1}{9}, V_{ref} = +12\,V$.

The value of V_o is given by ----------. (Note: You may use the virtual ground concept.)



Options :

1. ✔ $\frac{16}{3}\,V$

2. ✖ $\frac{8}{3}\,V$

3. ✗ $\frac{4}{3}V$

4. ✗ $3\,V$

Question Number : 35 Question Id : 9003001235 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the voltage transmission characteristic of an op amp configuration is $\frac{V_o}{V_i} = \frac{1-j\omega RC}{1+j\omega RC}$.

For $R \to \infty$, the phase is ---------- radians.

Options :

1. ✗ $\frac{\pi}{2}$

2. ✗ $-\frac{\pi}{2}$

3. ✗ 2π

4. ✓ $-\pi$

Question Number : 36 Question Id : 9003001236 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a BJT-based phase shift oscillator start oscillations when the following inequality is satisfied: $h_{fe} > 4k + 23 + \left(\frac{29}{k}\right)$, where k is ratio of two resistances in the oscillator circuits. The value of k that gives minimum h_{fe} is ----------.

Options :

1. ✔ $\sqrt{\frac{29}{4}}$

2. ✖ $\sqrt{\frac{19}{4}}$

3. ✖ $\sqrt{\frac{39}{4}}$

4. ✖ $\sqrt{\frac{9}{4}}$

Question Number : 37 Question Id : 9003001237 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the operation of the 555 timer in the monostable mode. Suppose that the external circuit components are $R = 1\ M\Omega, C = 0.01\ nF$. The pulse width is approximately ----------.

Options :

1. ✖ $1.1\ \mu s$

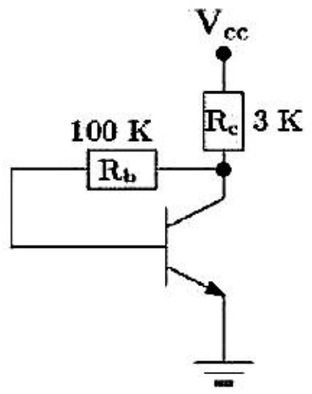
2. ✔ $11\ \mu s$

3. ✖ $0.11\ ns$

4. ✖ $5.5\ \mu s$

Question Number : 38 Question Id : 9003001238 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the BJT circuit shown in the Figure. In it, $\beta = 99, I_B = 28\ \mu A$. Assume that $V_{BE} = 0.8\ V$.
The value of V_{CC} is equal to ----------.



Options :

1. ✗ $5\ V$

2. ✗ $10\ V$

3. ✓ $12\ V$

4. ✗ $15\ V$

Question Number : 39 Question Id : 9003001239 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an amplifier with open loop voltage gain $A_V = 1000 \pm 90$ is available. It is required to have an amplifier whose voltage gain varies by no more than ± 0.1 %. The reverse transmission factor β of the network is approximately ----------.

Options :

1. ✗ 0.03

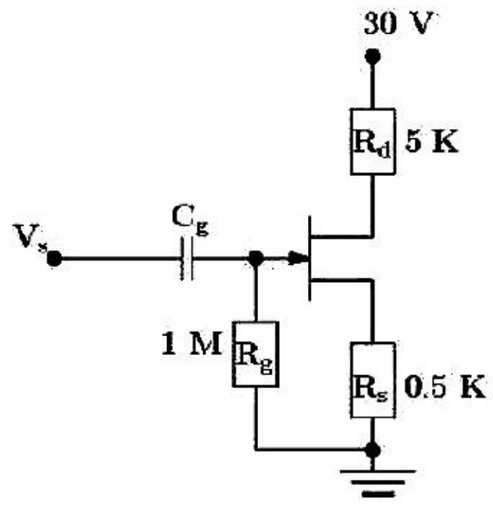
2. ✗ 0.06

3. ✗ 0.01

4. ✓ 0.09

Question Number : 40 Question Id : 9003001240 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the depletion-type FET circuit shown in the Figure. The drain current (in mA) is given by $I_D = 16(1 + 0.25\, V_{GS})^2$. The valid quiescent drain current is ----------.



Options :

1. ✗ $1\ mA$

2. ✖ $2\ mA$

3. ✔ $4\ mA$

4. ✖ 3 mA

Question Number : 41 Question Id : 9003001241 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following Boolean function: $F = (X + WY + UV)(X + WY + Z) + (\overline{W} + \overline{Y}) + (\overline{U} + \overline{V} + \overline{Z})$.
The simplified expression is equal to ----------.

Options :

1. ✖ 0

2. ✔ 1

3. ✖ X

4. ✖ $\overline{X}$

Question Number : 42 Question Id : 9003001242 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $D = A + B$. Suppose that the Boolean function $\overline{F} = B\,\overline{C} + A\,C$. The Boolean function F such that $F + \overline{F} = 1$ is given by ----------.

Options :

1. ✖ $C + D$

2. ✖ $\overline{C} + D$

3. ✓ $C + \overline{D}$

4. ✗ $C\overline{D}$

Question Number : 43 Question Id : 9003001243 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a certain logic family has the following voltage characteristic parameters:

$$V_{IH}(min) = 3.6\,V, \quad V_{IL}(max) = 1.0\,V;$$

$$V_{OH}(min) = 4.8\,V, \quad V_{OL}(max) = 0.1\,V$$

The largest rising noise spike that can be tolerated is ----------.

Options :

1. ✗ $100\ mV$

2. ✗ $200\ mV$

3. ✗ $600\ mV$

4. ✓ $900\ mV$

Question Number : 44 Question Id : 9003001244 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the data for a dual 4 −input CMOS logic NAND gate. The data sheet associated with the logic gate shows $V_{cc}(max) = 7\,V$, average static power supply current is $20\,\mu A$. The average power dissipation per gate is ----------.

Options :

1. ✗ $140\ \mu W$

2. ✗ $120\ \mu W$

3. ✗ $60\ \mu W$

4. ✓ $70\ \mu W$

Question Number : 45 Question Id : 9003001245 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a five-bit binary counter has initial state 00000. The count (in binary) after 144 input pulses is ----------.

Options :

1. ✗ 1000

2. ✓ 10000

3. ✗ 00100

4. ✗ 11111

Question Number : 46 Question Id : 9003001246 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

How many NAND gates are needed to implement a full adder that has inputs A, B, C_{in} and outputs S, C_{out}?

Options :

1. ✗ 6

2. ✓ 9

3. ✗ 12

4. ✗ 11

Question Number : 47 Question Id : 9003001247 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a 10 −bit binary ripple counter. It uses a flip-flop that has 3 ns delay from the time the clock edge occurs to the time the output is complemented. The maximum frequency at which the counter can be reliably operated is ----------.

Options :

1. ✗ 3.3 MHz

2. ✗ 0.33 MHz

3. ✓ 33.3 MHz

4. ✗ 66.6 MHz

Question Number : 48 Question Id : 9003001248 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a ROM chip of 4096×8 bits that has two chip select inputs and operates from a $5\,V$ power supply. The number of pins required for the IC package is ----------.

Options :

1. ✗ 20

2. ✖ 22

3. ✖ 26

4. ✔ 24

Question Number : 49 Question Id : 9003001249 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that we need a DAC that can span 12 V with a resolution of 20 mV or less. The minimum number of bits needed is ----------.

Options :

1. ✖ 4

2. ✖ 6

3. ✖ 8

4. ✔ 10

Question Number : 50 Question Id : 9003001250 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a 3 –bit Gray code to binary converter. The number of XOR gates required for the implementation is ----------.

Options :

1. ✔ 2

2. ✖ 3

3. ✖ 4

4. ✖ 5

Question Number : 51 Question Id : 9003001251 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a certain memory chip stores $8K$ 16−bit words. The capacity of the memory chip in bytes is ---------

Options :

1. ✖ 8192

2. ✔ 16384

3. ✖ 65536

4. ✖ 4096

Question Number : 52 Question Id : 9003001252 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the time required to execute an instruction of $18\,T$ states is $3.6\,\mu s$. The clock frequency is ----------.

Options :

1. ✖ $2\,MHz$

2. ✖ $10\,MHz$

3. ✔ $5\,MHz$

4. ✖ $1\ MHz$

Question Number : 53 Question Id : 9003001253 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following program that uses 8085 instructions:

LXI	B, 2479H
LXI	B, 3796H
LDAX	B
MOV	L, A
LDAX	D
STAX	B
MOV	A, L
STAX	D

The memory requirement of the code is ----------.

Options :

1. ✖ $14\ bytes$

2. ✖ $18\ bytes$

3. ✖ $10\ bytes$

4. ✔ $12\ bytes$

Question Number : 54 Question Id : 9003001254 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the contents of the Accumulator and the register B are, $3EH$ and, $6CH$, respectively.
The execution of the instruction "ADD B" results in the following content in the Accumulator.

Options :

1. ✗ $9AH$

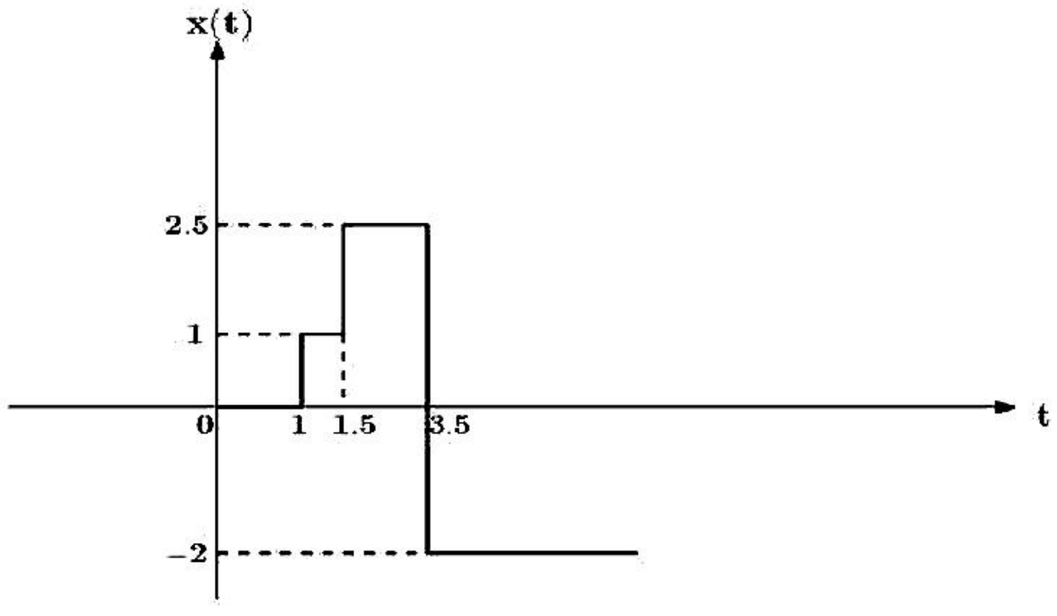
2. ✓ AAH

3. ✗ BAH

4. ✗ $9CH$

Question Number : 55 Question Id : 9003001255 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the signal shown in the Figure. Let $X(s)$ denote the Laplace transform of the signal $x(t)$. The value of the limit $\lim_{s\to 0} sX(s)$ is equal to ----------.



Options :

1. ✖ 0

2. ✔ -2

3. ✖ -1

4. ✖ 1

Question Number : 56 Question Id : 9003001256 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the impulse response of an LTI system is given by

$h(t) = 2^{-t}\cos(\omega_0 t)\,u(t)$. The system function $H(s)$ has zero at --------.

Options :

1. ✖ $s = 2$

2. ✖ $s = -2$

3. ✖ $s = \ln 2$

4. ✔ $s = -\ln 2$

Question Number : 57 Question Id : 9003001257 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a discrete-time LTI system which has input $x[n]$ and output $y[n]$. Consider the following facts:

- If $x[n] = \left(\frac{1}{3}\right)^n u[n]$ for all n, then $y[n]$ is of the form: $y[n] = b\left(\frac{1}{9}\right)^n u[n] + \delta[n]$, where b is a constant.
- $H(-3) = 0$.

The value of b is equal to ----------.

Options :

1. ✓ $-\frac{28}{27}$

2. ✗ $-\frac{14}{27}$

3. ✗ $-\frac{26}{27}$

4. ✗ $-\frac{29}{27}$

Question Number : 58 Question Id : 9003001258 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a discrete-time sequence $x[n] = \left(\frac{4}{9}\right)^{|n|}$. The region of convergence (RoC) of the sequence is given by ----------.

Options :

1. ✗ $|z| < \frac{9}{4}$

2. ✗ $|z| < \frac{4}{9}$

3. ✓ $\frac{4}{9} < |z| < \frac{9}{4}$

4. ✗ $|z| > \frac{9}{4}$

Question Number : 59 Question Id : 9003001259 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that $x[n]$ is a real discrete-time periodic signal with period N and complex discrete-time Fourier series (DTFS) coefficients a_k. Consider the rectangular form of $a_k = b_k + j\ c_k$, where b_k and c_k are both real. The value of $b_{-k}c_{-k} + b_k c_k$ is equal to ----------.

Options :

1. ✗ 1

2. ✓ 0

3. ✗ -1

4. ✗ j

Question Number : 60 Question Id : 9003001260 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the function $a_k = \sum_{n=0}^{8} x[n]\ e^{\frac{j2\pi}{9}nk}$.

Suppose that $x[n] = e^{j2\pi}$. Then a_k, for $k = 0, \pm 9, \pm 18, \pm 27, \ldots$ is given by

Options :

1. ✗ $a_k = 0$

2. ✗ $a_k = 1$

3. ✓ $a_k = 9$

4. ✗ $a_k = 8$

Question Number : 61 Question Id : 9003001261 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A causal discrete-time LTI system is characterized by the following first order difference equation:

$$y[n] = a\,y[n-1] + bx[n] + cx[n-1], a < 1.$$

Which of the following is a valid relationship among a, b and c, when $\left|H\left(e^{j\omega}\right)\right|_{\omega=\pi} = 1$?

Options :

1. ✓ $a + b - c = -1$

2. ✗ $a + b + c = -1$

3. ✗ $a + b - c = 1$

4. ✗ $a + b + c = 1$

Question Number : 62 Question Id : 9003001262 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider two LTI systems with impulse responses $h(t)$, $g(t)$. One LTI system is inverse of other. Let $H(j\omega), G(j\omega)$ denote the continuous-time Fourier transform of $h(t), g(t)$, respectively. Which of the following is true? ($*$ denotes convolution)

Options :

1. ✗ $H(j\omega) * G(j\omega) = 1$

2. ✓ $H(j\omega)\, G(j\omega) = 1$

3. ✗ $H(j\omega)\, G(j\omega) = \delta(\omega)$

4. ✗ $H(j\omega) * G(j\omega) = \delta(\omega)$

Question Number : 63 Question Id : 9003001263 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following impulse response: $h(t) = \sum_{m=0}^{\infty} e^{-mT}\, \delta(t - mT)$.
What is the approximate value of $G(j\omega)$ at $\omega = 0$?
Assume that $e^{-T} < 1$. $(e = 2.718 \ldots)$

Options :

1. ✗ $\frac{1}{e}$

2. ✗ e

3. ✗ $e - 1$

4. ✓ $1 - \frac{1}{e}$

Question Number : 64 Question Id : 9003001264 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a discrete-time LTI system with the property that if the input $x[n] = 0$, for all $n \geq L_1$, then the output $y[n] = 0$, for all $n \geq L_1 + L_2$, where L_1, L_2 are positive integers. What condition should the impulse response $h[n]$ satisfy for this to be true?

Options :

1. ✗ $h[n] = 0$ for all $n > L_2 + 1$

2. ✓ $h[n] = 0$ for all $n > L_2$

3. ✗ $h[n] = 0$ for all $n > L_2 - 1$

4. ✗ $h[n] = 0$ for all $L_1 < n < L_2$

Question Number : 65 Question Id : 9003001265 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following discrete-time sequences: $x[n] = u[n] - u[n-4]$, $h[n] = \left(\frac{1}{2}\right)^n u[n]$.

Let $y[n] = x[n] * h[n]$. The value of $y[n]$ at n = 2 is equal to ---------.

Options :

1. ✗ $\frac{1}{4}$

2. ✗ $\frac{3}{4}$

3. ✗ $\frac{5}{4}$

4. ✓ $\frac{7}{4}$

Question Number : 66 Question Id : 9003001266 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $0 < a < 1, 0 < b < 1$. Consider the following discrete-time sequences:

$$x[n] = a^n\, u[n], h[n] = b^n\, u[n].$$

Let $y[n] = x[n] * h[n]$, $*$ denotes convolution. For all $n \geq 0$, the value of $y[1]$ for $a \neq b$ is equal to --------.

Options :

1. ✓ $b + a$

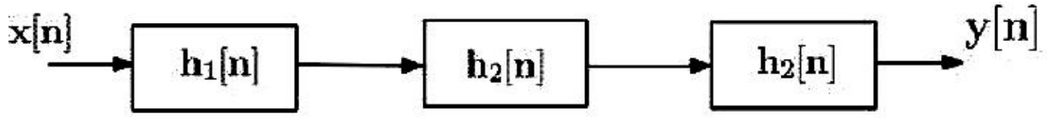
2. ✗ $b - a$

3. ✗ ab

4. ✗ 0

Question Number : 67 Question Id : 9003001267 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the cascade connection of three causal LTI systems as shown in the Figure. Suppose $x[n] = \delta[n] - \delta[n-1]$ and $h_2[n] = u[n] - u[n-2]$. If the overall system impulse response $h[n] = a\, h_1[n] + b\, h_1[n-1] + c\, h_1[n-2]$, then (a, b, c) = ----------.



Options :

1. ✖ $(a, b, c) = (1, 1, 2)$

2. ✔ $(a, b, c) = (1, 2, 1)$

3. ✖ $(a, b, c) = (2, 1, 1)$

4. ✖ $(a, b, c) = (1,1, 1)$

Question Number : 68 Question Id : 9003001268 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following modulated signal $y(t)$ having group delay, denoted by τ_g, and phase delay, denoted by τ_p.

$$y(t) = \frac{1}{20}[cos\{(1000 + 10^5)t - 10^{-5} - 1.8\} + cos\{(-1000 + 10^5)t - 10^{-5} + 1.8\}].$$

The values of τ_g, and τ_p, respectively, are --------, --------.

Options :

1. ✔ $10\ ns, 18\ \mu s$

2. ✖ $1\ ns, 1.8\ \mu s$

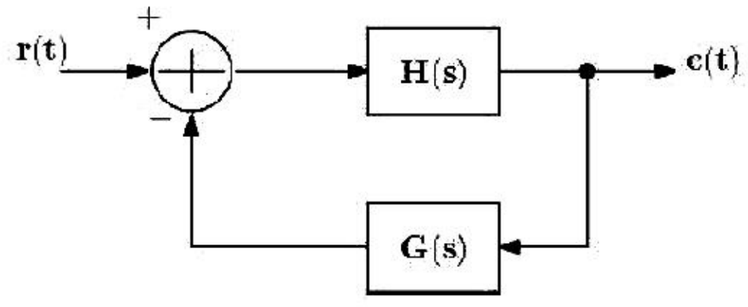
3. ✖ $1\ ns, 180\ \mu s$

4. ✖ $10\ ns, 0.18\ \mu s$

Question Number : 69 Question Id : 9003001269 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time :

N.A Think Time : N.A Minimum Instruction Time : 0

Consider the feedback system shown in the Figure. Suppose that $H(s) = \frac{1}{s+e^{j\pi}}, G(s) = s - k$. The condition on k for which the system is stable is ----------.



Options :

1. ✗ $k < 0$

2. ✗ $k < 1$

3. ✓ $k < -1$

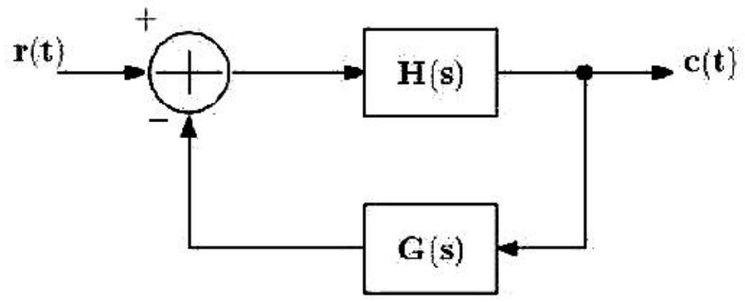
4. ✗ $0 < k < 1$

Question Number : 70 Question Id : 9003001270 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The figure depicts a closed loop control system. Suppose that $r(t)$ and $c(t)$ are related by the differential equation

$$\ddot{c}(t) + \dot{c}(t) + c(t) = \dot{r}(t).$$

Suppose that $G(s) = \frac{1}{s}$, $H(s)$ is given by ----------. (Note: Assume no initial conditions.)



Options :

1. ✗ $\frac{1}{s}$

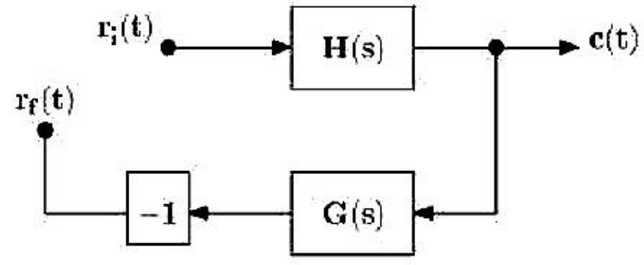
2. ✗ $\frac{1}{s-1}$

3. ✗ $\frac{s}{s+1}$

4. ✓ $\frac{1}{s+1}$

Question Number : 71 Question Id : 9003001271 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the system shown in the Figure. The relationship between $G(s)$ and $H(s)$ such that $r_f(t) = r_i(t)$ is given by ----------.



Options :

1. ✓ $G(s)H(s) = e^{j\pi}$

2. ✗ $G(s)H(s) = -e^{j\pi}$

3. ✗ $G(s)H(s) = e^{j\frac{\pi}{2}}$

4. ✗ $G(s)H(s) = e^{-j\frac{\pi}{2}}$

Question Number : 72 Question Id : 9003001272 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the system function of voltage signal amplification subsystem is given by $H(s) = \frac{GB}{s+B}$

The dc gain of the voltage amplifier in dB is equal to ----------.

Options :

1. ✗ $20\ log_{10}(GB)$

2. ✗ $20\ log_{10}\left(\frac{G}{B}\right)$

3. ✓ $20\ log_{10}(G)$

4. ✗ $20\ log_{10}(G^{-1})$

Question Number : 73 Question Id : 9003001273 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the system: $\dot{x} = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u, \quad y = [0 \quad 1]x.$

The transfer function for the system is given by ----------.

Options :

1. ✗ $\frac{1}{s+1}$

2. ✓ $\frac{1}{s+2}$

3. ✗ $\frac{1}{(s+1)(s+2)}$

4. ✗ $\frac{s+1}{s+2}$

Question Number : 74 Question Id : 9003001274 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the transfer function of a lead compensator is $H_c(s) = \frac{s+1}{0.09s+1}$. The angular frequency at which the maximum phase lead occurs is approximately ----------.

Options :

1. ✓ $3.33\ rad/s$

2. ✖ $6.66\ rad/s$

3. ✖ $9\ rad/s$

4. ✖ $0.33\ rad/s$

Question Number : 75 Question Id : 9003001275 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the open loop transfer function of a unity feedback system is given by

$G(s) = \frac{k}{s(0.01s+1)(0.04s+1)}$, where k is some real constant. The polar plot of $G(j\omega)$ crosses the real axis at ----------.

Options :

1. ✖ $25\ rad/s$

2. ✔ $50\ rad/s$

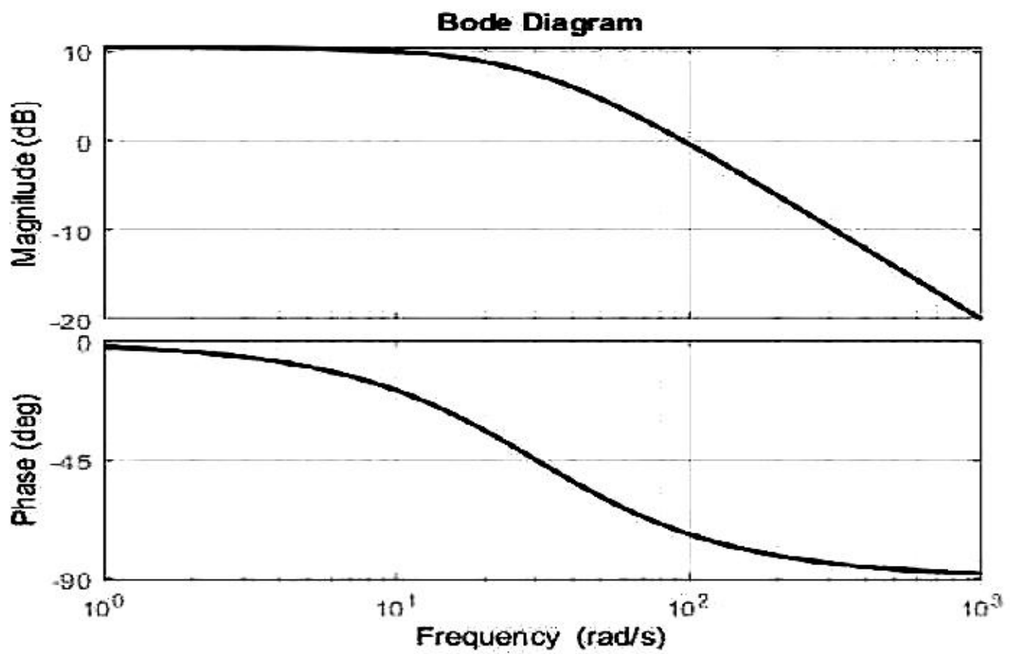
3. ✖ $75\ rad/s$

4. ✖ $100\ rad/s$

Question Number : 76 Question Id : 9003001276 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Refer to the Bode plot shown. Which of the following is a valid transfer function associated with the Bode plot?

Note: f −scale: $[10^0\ \ 10^1\ \ 10^2\ \ 10^3]$. Magnitude (dB): $[-20\ \ -10\ \ 0\ \ 10]$, and Phase angle (degrees): $[-90°\ \ -45°\ \ 0°]$.



Options :

1. ✗ $G(s) = \frac{1}{(s+30)}$

2. ✓ $G(s) = \frac{100}{(s+30)}$

3. ✗ $G(s) = \frac{10}{(s+30)}$

4. ✗ $G(s) = \frac{1}{s(s+30)}$

Question Number : 77 Question Id : 9003001277 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time :

N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that for a feedback system, the open-loop transfer function is

$G(s)H(s) = \frac{100\,k\,(1+0.1s)^2}{s^3}, k > 0$. The feedback system is stable for ----------.

Options :

1. ✓ $k > 5$

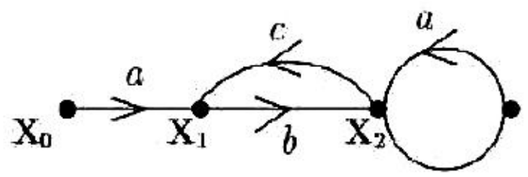
2. ✗ $k > 10$

3. ✗ $0 < k < 5$

4. ✗ $0 < k < 10$

Question Number : 78 Question Id : 9003001278 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For the signal flow graph shown in the Figure, $\frac{X_2}{X_0}$ is given by ----------.



Options :

1. ✓ $\frac{ab}{1-a-bc}$

2. ✗ $\frac{ab}{1+a-bc}$

3. ✗ $\frac{ab}{1-a+bc}$

4. ✗ $\frac{ab}{1-bc}$

Question Number : 79 Question Id : 9003001279 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a unity feedback system is having the forward path transfer function

$G(s) = \frac{5(s+4)}{(s+2)(s+1)}$. Further, $R(s) = \frac{1}{s}$.

The percentage of the steady state error is approximately ----------.

Options :

1. ✗ 11.11 %

2. ✓ 9.09 %

3. ✗ 21.11 %

4. ✗ 1.11 %

Question Number : 80 Question Id : 9003001280 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the closed-loop transfer function of a feedback system $\frac{C(s)}{R(s)} = \frac{256}{4s^2+s+256}$.

The natural angular frequency of oscillation and damping ratio, respectively, are given by ------.

Options :

1. ✗ $4\ rad/s, 0.0156$

2. ✗ $8\,rad/s, 0.0312$

3. ✗ $4\,rad/s, 0.0312$

4. ✓ $8\,rad/s, 0.0156$

Question Number : 81 Question Id : 9003001281 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the transfer function of a first-order process is given by $\frac{C(s)}{R(s)} = \frac{9}{\left(\frac{s}{9}\right)+1}$. Let the step input is $Au(t)$.

The step response is given by ----------.

Options :

1. ✗ $9A\,e^{-9t}\,u(t)$

2. ✗ $9At\,e^{-9t}\,u(t)$

3. ✓ $9A(1-e^{-9t})u(t)$

4. ✗ $9A\left(1-e^{-\frac{t}{9}}\right)u(t)$

Question Number : 82 Question Id : 9003001282 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the following polynomial in s: $s^5 + 3\,s^4 + 5\,s^3 + 4s^2 + 3$. The number of roots of the polynomial in the left half plane is ----------.

Options :

1. ✗ 2

2. ✗ 0

3. ✓ 3

4. ✗ 1

Question Number : 83 Question Id : 9003001283 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an AWGN channel with a bandwidth of $2B$ and received signal power P_s. Suppose that the two-sided noise power spectral density (PSD) is $\frac{N_0}{2}$ watt/Hz. Let SNR, denoted by γ is defined as the signal power to noise power ratio. How much does the normalized capacity per unit bandwidth approximately increase by doubling the received power (in watt)?

Options :

1. ✓ $log_2\left(\frac{1+2\gamma}{1+\gamma}\right)$

2. ✗ $log_2\left(\frac{2\gamma}{1+\gamma}\right)$

3. ✗ $log_2\left(\frac{\gamma}{1+2\gamma}\right)$

4. ✗ $2\,log_2\left(\frac{2\gamma}{1+\gamma}\right)$

Question Number : 84 Question Id : 9003001284 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A digital communication system uses an 8−ary signaling scheme with a baud rate of 3.6×10^6 symbols per second. Assume that four equally likely symbols are chosen. The source information rate in bits per second (bps) is equal to ----------.

Options :

1. ✗ 1.2 Mbps

2. ✗ 28.8 Mbps

3. ✓ 10.8 Mbps

4. ✗ 3.6 Mbps

Question Number : 85 Question Id : 9003001285 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the figure of merit (FoM) of single-tone AM and FM receivers. Suppose that the FoM of wideband FM is 108 times to the FoM of AM. Further, the wideband FM modulation index is 6. The modulation efficiency of AM is equal to ----------.

Options :

1. ✗ 25%

2. ✓ 50%

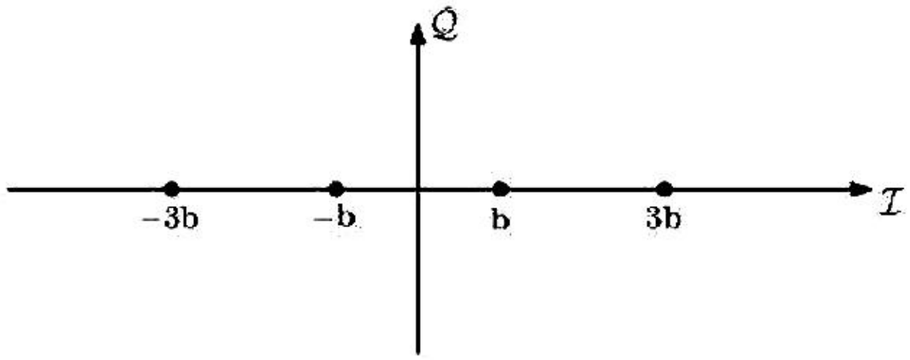
3. ✗ 100%

4. ✗ 150%

Question Number : 86 Question Id : 9003001286 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the PAM constellation shown. Suppose that the average energy per symbol is equal to 10.

The value of b is equal to ----------.



Options :

1. ✗ $\sqrt{5}$

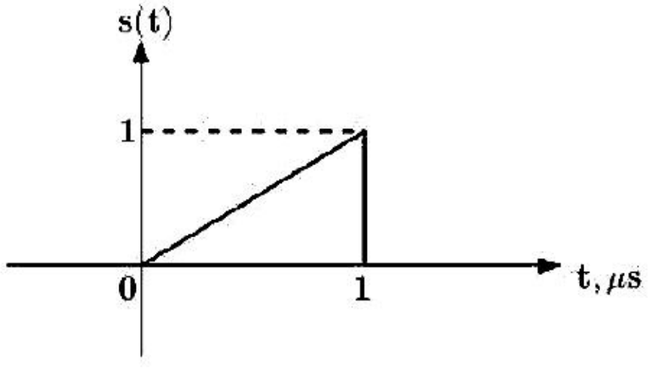
2. ✗ $\frac{1}{\sqrt{2}}$

3. ✓ $\sqrt{2}$

4. ✗ $\sqrt{10}$

Question Number : 87 Question Id : 9003001287 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the finite-energy pulse shown in the Figure. Suppose that the signal $s(t)$ is applied to a matched filter whose impulse response is matched to $s(t)$. Assuming an additive white noise of zero mean and two-sided spectral density 10^{-20} W/Hz, the maximum signal-to-noise ratio (in linear scale) at the matched filter output is approximately equal to ---------.



Options :

1. ✗ 13.33

2. ✗ 23.33

3. ✓ 33.33

4. ✗ 0.33

Question Number : 88 Question Id : 9003001288 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a baseband binary-PAM communication system. The bit rate of the transmitter is 72 Mbps. Suppose that a raised-cosine pulse shaping filter of roll-off factor 0.4 is used to reduce intersymbol interference; the transmission bandwidth in KHz is approximately equal to ----------.

Options :

1. ✓ 49 MHz

2. ✖ 98 MHz

3. ✖ 72 MHz

4. ✖ 36 MHz

Question Number : 89 Question Id : 9003001289 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the continuous-time signal $g(t) = \sqrt{2}\, exp(-t)u(t)$, where u(t) denotes the unit-step function. The maximum value of the autocorrelation function is equal to ----------.

Options :

1. ✖ 2

2. ✔ 1

3. ✖ 0.5

4. ✖ $\sqrt{2}$

Question Number : 90 Question Id : 9003001290 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a unit impulse $\delta(t)$ is applied to a Hilbert transformer with impulse response $\frac{1}{\pi t}$ followed by a Gaussian filter characterized by $H(f) = exp(-0.5\pi f^2)$. The energy of the output signal is equal to --------.

Options :

1. ✖ 0.5

2. ✔ 1

3. ✖ 2

4. ✖ 0.25

Question Number : 91 Question Id : 9003001291 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that an RF carrier signal of frequency 90 MHz is frequency modulated by a sine-wave of amplitude 18 volts and frequency 18 KHz. The frequency sensitivity of the modulator is 5 Hz/mV. The approximate bandwidth of the FM signal is equal to ----------.

Options :

1. ✖ 108 KHz

2. ✖ 54 KHz

3. ✔ 216 KHz

4. ✖ 180 KHz

Question Number : 92 Question Id : 9003001292 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider two 100 Ω resistors, connected in series, at $T = 300°K$. What is the approximate root mean square (RMS) noise voltage $\sqrt{E\{V_n^2\}}$ due to the thermal noise? Assume bandwidth of 1 MHz and Boltzmann constant $k = 1.38 \times 10^{-23} J/°K$.

Options :

1. ✔ 1.8 microvolt

2. ✖ 0.18 microvolt

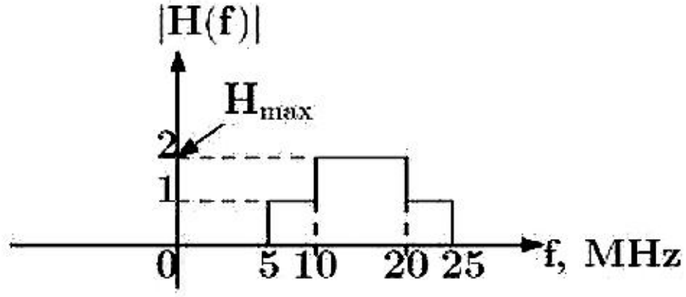
3. ✖ 0.18 millivolt

4. ✖ 18 microvolt

Question Number : 93 Question Id : 9003001293 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The equivalent noise bandwidth of a filter, denoted by W_n, is defined as $W_n = \int_0^\infty \left|\frac{H(f)}{H_{max}}\right|^2 df$.

Consider the magnitude response of a filter shown in Figure. The equivalent noise bandwidth W_n is equal to ----------.



Options :

1. ✖ 25 MHz

2. ✔ 12.5 MHz

3. ✖ 50 MHz

4. ✖ 1.25 MHz

Question Number : 94 Question Id : 9003001294 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a straight line random process given by $L(t) = U + Vt$, where U and V are uncorrelated standard Gaussian random variables with mean 0 and variance 1. The value of the autocorrelation function $R_L(t_1, t_2)$ for $t_1 = t_2 = \frac{1}{2}$ is equal to ----------.

Options :

1. ✓ $\frac{5}{4}$

2. ✗ $\frac{7}{4}$

3. ✗ $\frac{1}{4}$

4. ✗ $\frac{9}{4}$

Question Number : 95 Question Id : 9003001295 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the TDMA frame having 8 timeslots. One of the timeslots is shown in the Figure. The transmission rate is 270.833 kbps.

The frame duration is approximately equal to ----------. (Note: $\frac{1}{270.833} \approx 0.0037$.)

Start bits (3)	Data bits (58)	Training bits (28)	Data bits (58)	Stop bits (3)	Guard Time (8.25 bits)

Fig. TDMA frame in GSM standard

Options :

1. ✗ $2.3\ ms$

2. ✓ $4.6\ ms$

3. ✗ $0.46\ ms$

4. ✗ $0.23\ ms$

Question Number : 96 Question Id : 9003001296 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A coherent BPSK communication system operates at a bit rate of 10 Mbps. The received SNR is 10 dB. Further, the channel is assumed to be AWGN. In terms of the complementary error function ($erfc(.)$), approximate symbol error probability (SEP) is equal to ----------.

Options :

1. ✗ $0.5\ erfc(\sqrt{20})$

2. ✗ $erfc(\sqrt{20})$

3. ✖ $erfc(\sqrt{10})$

4. ✔ $0.5\ erfc(\sqrt{10})$

Question Number : 97 Question Id : 9003001297 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a radio telescope antenna has a gain of 2.5×10^5 and is operating at $1.5\ GHz$. If the physical aperture is $1200\ m^2$, the aperture efficiency is approximately -----. (Note: $\frac{1}{2\pi} \approx 0.16$.)

Options :

1. ✖ 33.3 %

2. ✔ 66.6 %

3. ✖ 77.7 %

4. ✖ 80 %

Question Number : 98 Question Id : 9003001298 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $E_n(\theta, \phi)$ denote the normalized electric field pattern of a directional antenna with directivity D.
Which of the following is true?

Options :

1. ✖ $\iint \left(E_n(\theta, \phi)\right)^2 d\theta\ d\phi = \pi D^{-1}$

2. ✖ $\iint \left(E_n(\theta, \phi)\right)^2\ d\theta\ d\phi = 2\pi D^{-1}$

3. ✗ $\iint \left(E_n(\theta,\phi)\right)^2 \, d\theta \, d\phi = 8\pi D^{-1}$

4. ✓ $\iint \left(E_n(\theta,\phi)\right)^2 \, d\theta \, d\phi = 4\pi D^{-1}$

Question Number : 99 Question Id : 9003001299 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a rectangular waveguide with $a \approx b$. Let n denote the refractive index of the dielectric inside the waveguide. The expression to compute approximate cutoff wavelength in TE_{11} mode is given by ----------.

Options :

1. ✗ $\lambda_c \approx na$

2. ✓ $\lambda_c \approx \sqrt{2}\, n\, a$

3. ✗ $\lambda_c \approx \frac{1}{\sqrt{2}}\, n\, a$

4. ✗ $\lambda_c \approx 2\, n\, a$

Question Number : 100 Question Id : 9003001300 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the electric field intensity vector is $E_y\, \hat{y}$ and the magnetic field intensity vector is given by $-H_x\, \hat{x} + H_z\, \hat{z}$. The poynting vector is given by ----------.

Options :

1. ✗ $(E_y H_z, 0, -E_y H_x)$

2. ✗ $(-E_yH_z, 0, E_yH_x)$

3. ✓ $(E_yH_z, 0, E_yH_x)$

4. ✗ $(-E_yH_z, 0, -E_yH_x)$

Question Number : 101 Question Id : 9003001301 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the dielectric slab waveguide has symmetric refractive index distribution $n^2(-x) = n^2(x)$.

Consider the wave equation

$$\frac{d^2\psi(x)}{dx^2} + (k_0^2 n^2(x) - \beta^2)\psi(x) = 0.$$

Which of the following is valid?

Options :

1. ✗ $\psi(-x) = \pm\sqrt{\psi(x)}$

2. ✓ $\psi(-x) = \pm\psi(x)$

3. ✗ $\psi(-x) = \psi^2(x)$

4. ✗ $\psi(-x) = \pm\frac{1}{\psi(x)}$

Question Number : 102 Question Id : 9003001302 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that approximate variation in the refractive index near the surface of the rod is given by $n(x) = n_1(1 - \alpha^{-\beta x}),\ \alpha > 1, \beta > 0$. Let Δn denote the gradient of n. The expression for $\left|\frac{\Delta n}{n}\right|$ is given by ----------.

Options :

1. ✓ $\frac{\beta\, \alpha^{-\beta} ln(\alpha)}{1-\alpha^{-\beta}}$

2. ✗ $\frac{\beta\, \alpha^{-\beta}}{1-\alpha^{-\beta} ln(\alpha)}$

3. ✗ $\beta\, \alpha^{-\beta} ln(\alpha)$

4. ✗ $\frac{\beta\, \alpha^{-\beta} ln(\alpha)}{1+\alpha^{-\beta}}$

Question Number : 103 Question Id : 9003001303 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a transmission line of length $9\ m$. It is immersed in a material with $\mu_r = 1,\ \epsilon_r = 2.25$. Further, the operating frequency is $25\ MHz$. The approximate wavelength at the operating frequency is ----------.

Options :

1. ✗ $2\ m$

2. ✗ $4\ m$

3. ✓ $8\ m$

4. ✗ $1\ m$

Question Number : 104 Question Id : 9003001304 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the use of a quarter wavelength transmission line for load matching. To match 600 Ω load to a 150 Ω line requires a quarter wave section of line having a characteristic resistance of ----------.

Options :

1. ✗ 100 Ω

2. ✗ 150 Ω

3. ✗ 375 Ω

4. ✓ 300 Ω

Question Number : 105 Question Id : 9003001305 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a coaxial cable with inner conductor radius a, outer conductor radius b, and V is the potential difference between the outer and the inner conductor. What is the unit of the quantity $\left[\frac{2\pi\epsilon V}{ln\left(\frac{b}{a}\right)}\right]$, where ϵ denotes the permittivity?

Options :

1. ✗ V/m

2. ✗ A/m

3. ✓ C/m

4. ✖ J/m

Question Number : 106 Question Id : 9003001306 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an RF antenna with the largest dimension of 24 cm. If the antenna is transmitting at a frequency of 1 GHz, the radiating far-field distance of the transmitter is ----------.

Options :

1. ✔ 384 cm

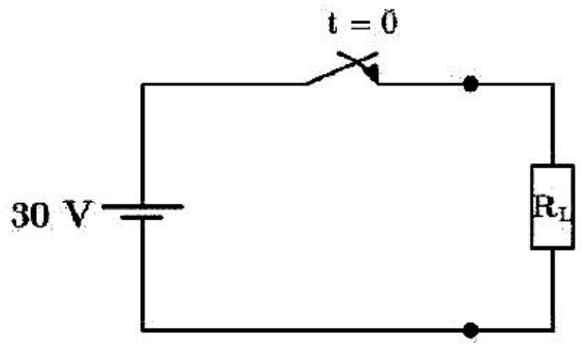
2. ✖ 192 cm

3. ✖ 160 cm

4. ✖ 320 cm

Question Number : 107 Question Id : 9003001307 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the transmission line as shown in the Figure. What is the characteristic resistance of the line when the voltage reflection coefficient at the load is 0.25 and $R_L = 200\ \Omega$?



Options :

1. ✖ $100\ \Omega$

2. ✔ $120\ \Omega$

3. ✖ $140\ \Omega$

4. ✖ $160\ \Omega$

Question Number : 108 Question Id : 9003001308 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a material has the following properties: $\sigma = 2\ S/m$, $\epsilon_r = 9, \mu_r = 16$. At a frequency of $1\ GHz$, the attenuation constant is approximately equal to ----------.

Options :

1. ✖ 80π

2. ✖ 320π

3. ✖ 40π

4. ✔ 160π

Question Number : 109 Question Id : 9003001309 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that the magnetic flux density in region 1 of an interface between two materials is given by $B_1 = 0.6\,\hat{x} + 0.4\,\hat{y}$. The permeability of region 1, denoted by μ_1, is twice the permeability of region 2, denoted by μ_2. The magnitude of magnetic flux density in region 2 is ----------.

Options :

1. ✓ $0.25\ Wb/m^2$

2. ✗ $0.5\ Wb/m^2$

3. ✗ $0.75\ Wb/m^2$

4. ✗ $1\ Wb/m^2$

Question Number : 110 Question Id : 9003001310 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose that a physical charge distribution is defined as

$$\rho(r) = 6 + r, \qquad 0 < r < 1.$$

The total charge contained inside the sphere of radius 1 is equal to ----------.

Options :

1. ✗ 3π

2. ✗ 6π

3. ✓ 9π

4. ✗ 12π

Question Number : 111 Question Id : 9003001311 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For what values of a and b the equations x+2y+3z = 4, x+3y+4z = 5, x+3y+az = b have no solutions

Options :

1. ✗ $a \neq 6, b \neq 5$

2. ✗ $a \neq 6, b = 5$

3. ✗ $a = 3, b = 5$

4. ✓ $a = 4, b \neq 5$

Question Number : 112 Question Id : 9003001312 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Eigen Values of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ are

Options :

1. ✗ 1, 1, 1

2. ✗ 0, 1, 1

3. ✓ 0, 0, 3

4. ✗ 1, 2, 0

Question Number : 113 Question Id : 9003001313 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The value of C of Rolle's theorem for $f(x) = \frac{\sin x}{e^x}$ in $(0, \pi)$ is

Options :

1. ✓ $\pi/4$

2. ✗ π

3. ✗ $\pi/3$

4. ✗ $\pi/2$

Question Number : 114 Question Id : 9003001314 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Value of normal vector to the surface $\Phi = xy^2 + yz^2$ at the point (2, -1, 1)

Options :

1. ✗ $i + 3j - 2k$

2. ✓ $i - 3j - 2k$

3. ✗ $i - 3j + 2k$

4. ✗ 0

Question Number : 115 Question Id : 9003001315 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

General Solution of $\frac{d^2y}{dx^2} + y = 0$

Options :

1. ✓ $y = C_1 Cosx + C_2 Sinx$

2. ✖ $y = C_1 Cosx - C_2 Sinx$

3. ✖ $y = C_1 e^x + C_2 e^{-x}$

4. ✖ $y = C_1 e^x - C_2 e^{-x}$

Question Number : 116 Question Id : 9003001316 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

General Solution of $\tan(px-y) = p$

Options :

1. ✔ $y = cx - \tan^{-1}c$

2. ✖ $y = cx + \tan^{-1}c$

3. ✖ $y = cx - \tan c$

4. ✖ $y = cx + \tan c$

Question Number : 117 Question Id : 9003001317 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $f(z) = \frac{e^{2z}}{(z-1)(z-2)}$, and C: $|z| = 3$. The value of $\int_c f(z)dz$ is

Options :

1. ✖ $2\pi i\,(e^4 + e^2)$

2. ✓ $2\pi i\ (e^4 - e^2)$

3. ✗ $2\pi i$

4. ✗ $-2\pi i$

Question Number : 118 Question Id : 9003001318 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $f(z) = \frac{1+e^z}{Sinz+zCosz}$, then the Residue at z = 0 is

Options :

1. ✗ 0

2. ✓ 1

3. ✗ πi

4. ✗ $2\pi i$

Question Number : 119 Question Id : 9003001319 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

6 coins are tossed, Probability of getting 2 to 4 heads using Normal Distribution is

Options :

1. ✗ 0.625

2. ✓ 0.785

3. ✗ 0.81

4. ✗ 0.435

Question Number : 120 Question Id : 9003001320 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The Iterative formula for 1/N by Newton's method is

Options :

1. ✓ $x_{n+1} = x_n(2 - Nx_n)$

2. ✗ $x_{n+1} = x_n(2 + Nx_n)$

3. ✗ $x_{n-1} = x_n(2 + Nx_n)$

4. ✗ $x_{n-1} = x_n(2 - Nx_n)$