AP PGECET QUESTION PAPER

2023



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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 29th May 2023 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
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Electronics and Communication Engineering

Section Id :	78773220
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
Is Section Default? :	null

Question Number : 1 Question Id : 7877322281 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a regular hexagonal planar graph of six nodes and connecting branches. The minimum number of branches that may be added to make the resulting structure non-planar is ------ (Note: Assume nonparallel branches.).

Options :

1. ✖ Two

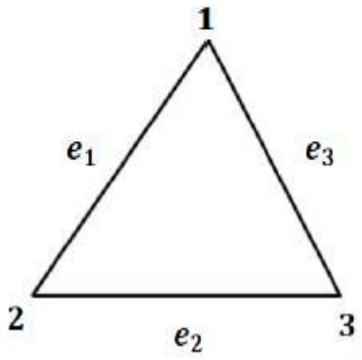
2. ✔ Three

3. ✖ Four

4. ✖ Six

Question Number : 2 Question Id : 7877322282 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a simple planar graph of three nodes and connected branches as depicted in the Figure. Let I denote the incidence matrix and let the matrix $C = I\, I^{tr}$, where $'tr'$ denotes transpose. The value of $|det(C)|$ is ----------.



Edges: e_1, e_2, e_3
Vertices: 1, 2, 3

Options :

1. ✔ 4

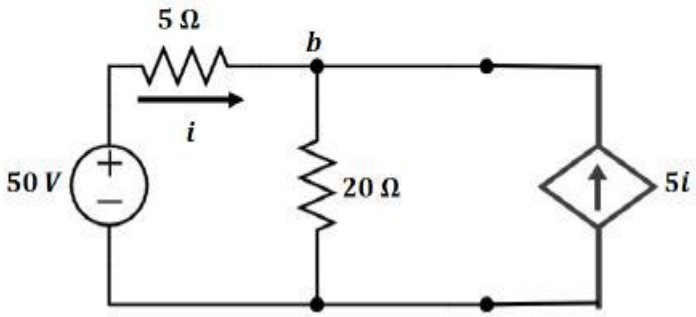
2. ✖ 8

3. ✖ 2

4. ✖ 1

Question Number : 3 Question Id : 7877322283 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 an electric circuit having one independent voltage source and dependent current source. Let V_b denote the voltage at the node b. The value of V_b is equal to ---------.



Options :

1. ✖ $16\ V$

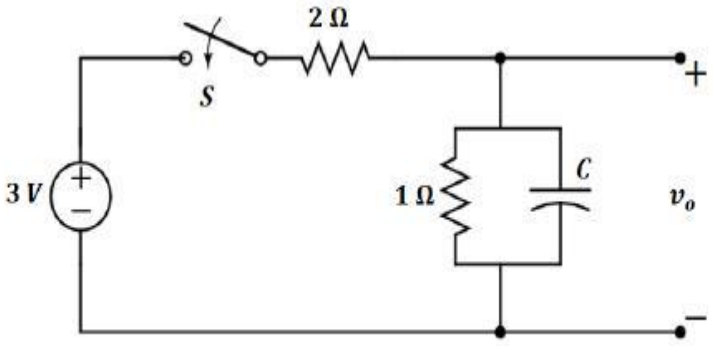
2. ✖ $32\ V$

3. ✖ $24\ V$

4. ✔ $48\ V$

Question Number : 4 Question Id : 7877322284 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 network shown in the Figure. Suppose $v_o(t_0) = 1.8\ V$. Further, at $t = t_0$, $\frac{dv_o}{dt} = -10\ V/s$, where t_0 is the time after the switch S is closed. The value of C is ----------.



Options :

1. ✖ $0.24\ F$

2. ✔ $0.12\ F$

3. ✖ $0.012\ F$

4. ✖ $0.024\ \mathrm{F}$

Question Number : 5 Question Id : 7877322285 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The capacitance values of four capacitors are $10\ \mu F, 20\ \mu F, 40\ \mu F$, and $80\ \mu F$. Suppose these are placed in parallel across a $200\ V$ source. The total charge residing in the capacitors is --------.

Options :

1. ✖ $3\ mC$

2. ✔ $30\ mC$

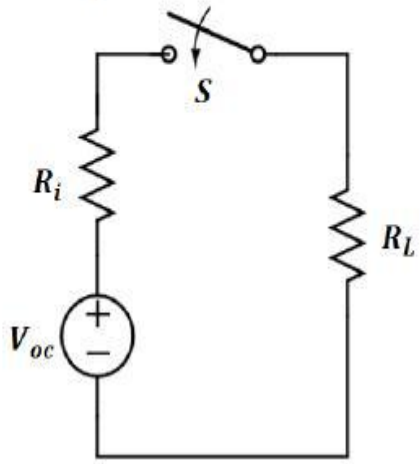
3. ✖ $0.3\ mC$

4. ✖ $0.15\ mC$

Question Number : 6 Question Id : 7877322286 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 with the switch S is closed. Suppose that the maximum power delivered to the load resistance is $9\,W$. Assuming $V_{oc} = 72\,V$, the load resistance can be shown to be equal to ----------.



Options :

1. ✖ $72\ \Omega$

2. ✖ $36\ \Omega$

3. ✔ $144\ \Omega$

4. ✖ $216\ \Omega$

Question Number : 7 Question Id : 7877322287 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a time varying signal $i(t)$ described over one period as follows:

$$i(t) = \begin{cases} t, & 0 < t < 0.5\ s, \\ 1, & 0.5 < t < 1\ s. \end{cases}$$

The value of I_{rms}^2 is approximately equal to ----------.

Options :

1. ✔ 0.54

2. ✖ 1.08

3. ✖ 0.27

4. ✖ 2.16

Question Number : 8 Question Id : 7877322288 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a series $R-L-C$ circuit. Let Q denotes the quality factor and B is the bandwidth. Which of the following relationship is valid?

Options :

1. ✖ $Q \propto B$

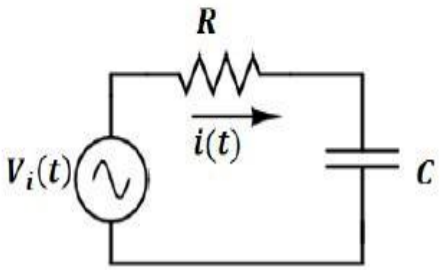
2. ✔ $Q \propto \frac{1}{B}$

3. ✖ $Q \propto \frac{1}{\sqrt{B}}$

4. ✖ Q is independent of B

Question Number : 9 Question Id : 7877322289 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The network shown in the Figure has a sinusoidal voltage source and is operating in the steady state. Suppose $V_i(t) = 2\cos(2t)$ and $RC = 0.5$. If the steady state current is of the form $A\cos(2t + \psi)$, the value of the phase angle ψ is equal to ---------.



Options :

1. ✖ π

2. ✖ $\frac{\pi}{2}$

3. ✔ $\frac{\pi}{4}$

4. ✖ $\frac{\pi}{3}$

Question Number : 10 Question Id : 7877322290 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For a resistive network, the Z −parameter matrix is given by $\begin{bmatrix} \frac{13}{7} & \frac{2}{7} \\ \frac{2}{7} & \frac{3}{7} \end{bmatrix}$.

The parameters C, D, respectively, are ------ and ------.

Options :

1. ✖ $\frac{5}{2}, \frac{7}{2}$

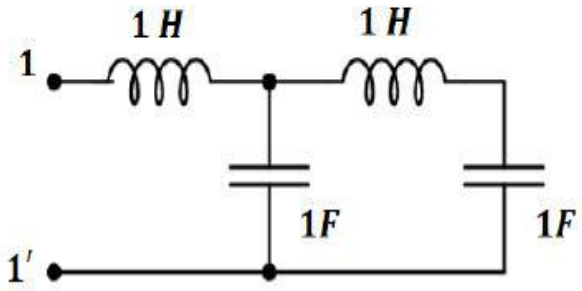
2. ✖ $\frac{3}{2}, \frac{13}{2}$

3. ✖ $\frac{13}{2}, \frac{7}{2}$

4. ✔ $\frac{7}{2}, \frac{3}{2}$

Question Number : 11 Question Id : 7877322291 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For the LC ladder network shown in the figure, let the driving point admittance $1-1'$ given by $Y(s)$, which can be expressed as $Y(s) = \frac{s^3+as}{s^4+bs^2+1}$. The values of a and b are ---- and, ----, respectively.



Options :

1. ✖ 1, 3

2.

✔ 2, 3

3. ✖ 3, 1

4. ✖ 1, 2

Question Number : 12 Question Id : 7877322292 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A 5 mH inductor is connected in parallel with 20 Ω resistor. This parallel combination is connected in series with a 25 μF capacitor and a 5 Ω resistor. Suppose the angular frequency is 2000 rad/s. The impedance of this interconnection is $z_r + j\, z_i$, where $j = \sqrt{-1}$. The values of z_r , and z_i, respectively, are ----------.

Options :

1. ✖ $12, -9$

2. ✖ $9, 12$

3. ✔ $9, -12$

4. ✖ $12, 9$

Question Number : 13 Question Id : 7877322293 Display Question Number : Yes Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The unit impulse response of a circuit is given by

$$v_o(t) = e^{-3t}\cos(\sqrt{18}\,t), t \geq 0.$$

The value of the transfer function $H(s)$ when $s = 0$ is ----------.

Options :

1. ✖ $\frac{1}{18}$

2. ✔ $\frac{1}{9}$

3. ✖ $\frac{1}{81}$

4. ✖ $\frac{1}{6}$

Question Number : 14 Question Id : 7877322294 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an RL series circuit excited by an impulsive voltage source $5\,\delta(t)\,V$. In the circuit, $R = 100\,\Omega, L = 0.5\,H$. In an infinitesimal moment, the impulsive voltage source stored ---------- of energy.

Options :

1. ✖ $125\,J$

2. ✖ $50\ J$

3. ✔ $25\ J$

4. ✖ $75\ J$

Question Number : 15 Question Id : 7877322295 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose a planar resistor has the following dimensions: i) Film thickness of 1 μm; ii) Film length of 1 cm; iii) Film width of 1 cm; Suppose the sheet resistivity of gold film is 24 Ω –nm. The planar resistance value in Ω/m^2 is ----------.

Options :

1. ✖ 0.24

2. ✔ 2.4

3. ✖ 0.12

4. ✖ 24

Question Number : 16 Question Id : 7877322296 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a Ge sample at $T = 300°K$ with doping concentration of $N_d = 0$ and $N_a = 10^{13}\ mm^{-3}$. Suppose the electron mobility and hole mobility are 4000 $cm^3/V.s$, and 2000 $cm^3/V.s$, respectively. The applied electric field is 50 V/cm. The approximate drift current density is ----------.

Options :

1. ✔ $160\ A/cm^2$

2. ✖ $320\ A/cm^2$

3. ✖ $80\ A/cm^2$

4. ✖ $32\ A/cm^2$

Question Number : 17 Question Id : 7877322297 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The approximate maximum wavelength of a light source that can generate electron hole pairs in InP (Indium Phosphide) is ----------. (Note: Energy band gap $\approx$ 1.35 eV.).

Options :

1. ✖ $720\ nm$

2. ✔ $920\ nm$

3. ✖ $460\ nm$

4. ✖ $1020\ nm$

Question Number : 18 Question Id : 7877322298 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an optical cavity of fixed length L. Suppose $N \gg 1$.

The wavelength separation between two adjacent resonant modes is ----------.

(Note: For resonance, cavity wavelength L must be an integral number of half wavelengths. That is, $N\left(\frac{\lambda}{2}\right) = L$.).

Options :

1. ✖ Inversely proportional to the wavelength λ.

2. ✖ Directly proportional to the wavelength λ.

3. ✔ Proportional to the square of the wavelength λ.

4. ✖ Inversely proportional to square of the wavelength λ

Question Number : 19 Question Id : 7877322299 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an n −channel junction field effect transistor (JFET). Suppose the internal pinch-off voltage is 4.4 V and the built-in potential barrier is 0.8 V. The magnitude of gate-to-source voltage to achieve pinch-off is ----------.

Options :

1. ✖ $1.2\ V$

2. ✖ $2.4\,V$

3. ✖ $5.2\,V$

4. ✔ $3.6\,V$

Question Number : 20 Question Id : 7877322300 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose a bipolar junction transistor is biased in the forward−active region. For a base current of $5\,\mu A$ and collector current of $0.625\,mA$, the value of the common−base current gain α is ----------.

Options :

1. ✖ 0.50

2. ✔ 0.99

3. ✖ 0.10

4. ✖ 1.10

Question Number : 21 Question Id : 7877322301 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The output resistance of a $p-n-p$ bipolar junction transistor (BJT) is equal to 200 $K\Omega$. The change in collector current when V_{EC} increases from 2 V to 6 V is equal to ----------.

(Note: The magnitude of the voltage at the intercept on the voltage axis obtained by extrapolating the I_C versus V_{CE} to zero current is known as Early voltage.).

Options :

1. ✖ $1\ \mu A$

2. ✖ $10\ \mu A$

3. ✔ $20\ \mu A$

4. ✖ $2\ \mu A$

Question Number : 22 Question Id : 7877322302 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose the subthreshold current in a MOSFET is given by $I_D = I_S e^{\frac{V_{GS}}{\eta V_T}}$. Assume $\eta = 1, V_T = 0.026\ V$. The change in applied V_{GS} for a factor of 16 times increase in I_D is approximately ----------. (Note: $\log_2 e \approx 0.69$.).

Options :

1. ✖ $23\ mV$

2. ✔ $69\ mV$

3. ✖ $46\ mV$

4. ✖ $6.9\ mV$

Question Number : 23 Question Id : 7877322303 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a neutral region of a Si diode to produce electron drift current density $J_n \approx 5.2\ A/cm^2$. Assume $\mu_n = 1300\ cm^2/V.s$ and the doping concentration is equal to $10^{16}\ cm^{-3}$. The electric field in the region is approximately ----------.

Options :

1. ✔ $2.5\ V/cm$

2. ✖ $5\ V/cm$

3. ✖ $0.25\ V/cm$

4. ✖ $0.5\ V/cm$

Question Number : 24 Question Id : 7877322304 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an n−type Si with permittivity $\epsilon \approx 10^{-12} F/cm$. If the dielectric relaxation time constant is 0.54 ps, the approximate conductivity is equal to -----.

Options :

1. ✖ $3.70\ \mho - cm$

2. ✔ $1.85\ \text{Ú} - cm$

3. ✖ $0.93\ \text{Ú} - cm$

4. ✖ $7.40\ \text{Ú} - cm$

Question Number : 25 Question Id : 7877322305 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the steps in planar technology for IC fabrication:

(i) Ion implantation (ii) Oxidation (iii) Diffusion (iv) Crystal growth.

The right sequence of the steps involved in the fabrication process are -----.

Options :

1. ✖ (i), (iii), (iv), (ii)

2. ✔ (iv), (ii), (iii), (i)

3. ✖ (ii), (iii), (i), (iv)

4. ✖ (i), (ii), (iv), (iii)

Question Number : 26 Question Id : 7877322306 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the sequence of steps in the IC fabrication process. In it, one of the key steps is photolithography, which is a ----------process.

Options :

1. ✖ Adding

2. ✖ Removing

3. ✔ Patterning

4. ✖ Heating

Question Number : 27 Question Id : 7877322307 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The probability that an energy level is occupied by an electron assuming the state is above the Fermi level by K_BT is approximately ----------. Here, K_B denotes the Boltzmann constant and T denotes the absolute temperature.

(Note: The value of $e \approx 2.7$.).

Options :

1. ✖ 37%

2. ✖ 18%

3. ✖ 54%

4. ✔ 27%

Question Number : 28 Question Id : 7877322308 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose the donor concentration in an n −type semiconductor at $T = 300°K$ is given by $N_D(x) = 10^{16}(1 - 1000x)\ cm^{-3},\ 0 \le x \le 1\ \mu m$. The induced electric field at the thermal equilibrium at $x = 0$ approximately is ----------.
(Note: $\frac{kT}{e} \approx 26\ mV$, where k is Boltzmann constant and e is the electron charge.).

Options :

1. ✖ $2.6\ V/cm$

2. ✔ $26\ V/cm$

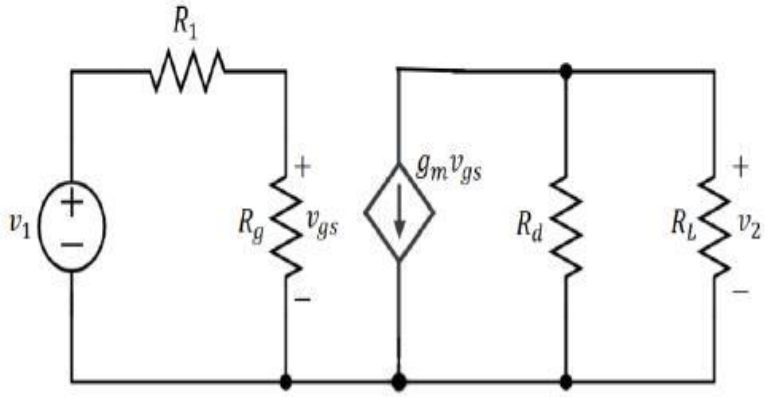
3. ✖ $52\ V/cm$

4. ✖ $5.2\ V/cm$

Question Number : 29 Question Id : 7877322309 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the FET amplifier (an approximate circuit model) shown in the Figure.

For the amplifier circuit, assuming $R_g \gg R_1, R_L \approx R_d$, Consider ratio of the voltages $\left|\frac{v_2}{v_1}\right|$. The value of $\left|\frac{v_2}{v_1}\right| \approx$ ----------.



Options :

1. ✖ $2\ g_m R_L$

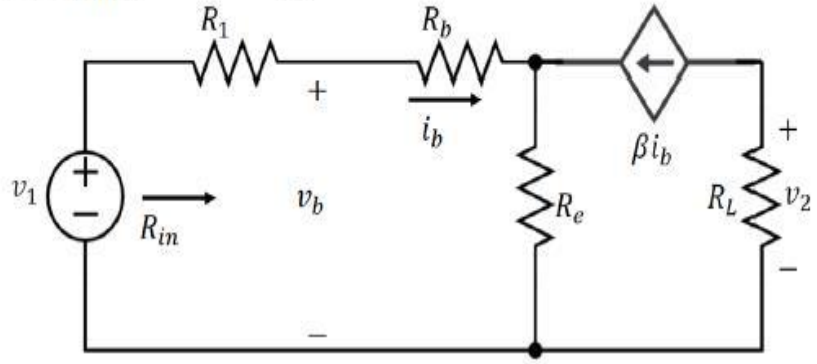
2. ✖ $g_m R_L$

3. ✔ $0.5\ g_m R_L$

4. ✖ $0.25\ g_m R_L$

Question Number : 30 Question Id : 7877322310 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the approximate circuit model of a BJT amplifier shown in the Figure.
Suppose $\beta = 49, R_L = 1.8\ K\Omega, R_e = 30\ \Omega, R_b = 300\ \Omega, R_1 = 100\ \Omega.$
The resistance R_{in} is ---------- Ω.



Options :

1. ✔ $1.8\ K$

2. ✖ $3.6\ K$

3. ✖ $0.9\ K$

4. ✖ $0.36\ K$

Question Number : 31 Question Id : 7877322311 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the basic building blocks of an electronic regulated power supply. A proper sequence of building blocks of the electronic regulated power supply (RPS) is ----------.

Options :

1. ✖ Filter ⇒ Voltage regulator ⇒ Rectifier

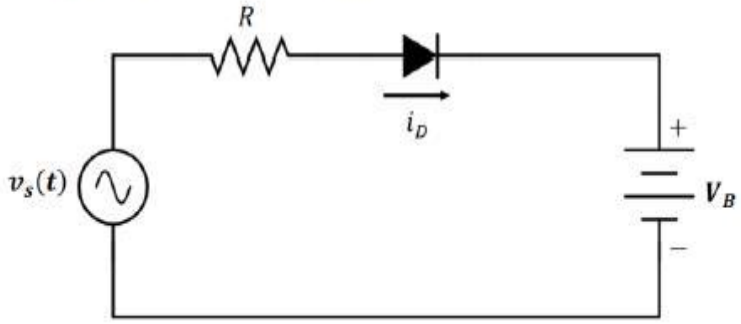
2. ✖ Rectifier ⇒ Voltage regulator ⇒ Filter

3. ✔ Rectifier ⇒ Filter ⇒ Voltage regulator

4. ✖ Voltage regulator ⇒ Filter ⇒ Rectifier

Question Number : 32 Question Id : 7877322312 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 shown. Suppose $V_B = 11\ V, R = 90\ \Omega, V_\gamma = 0.9\ V, v_s(t) = 29\sin(\omega t)\ V$. The peak diode current is ----------.



Options :

1. ✖ $95\ mA$

2. ✔ $190\ mA$

3. ✖ $290\ mA$

4. ✖ $380\ mA$

Question Number : 33 Question Id : 7877322313 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A voltage regulator has nominal output voltage of 10 V. The specified Zener diode power rating is 1 W, has a 10 V drop at the Zener current of $I_z = 25\ mA$, and has a Zener resistance of 5 Ω. The input power supply of 20 V can vary by ± 20 %. The output load current is to vary between 0 mA and 15 mA. If the minimum Zener current is to be $I_z = 5\ mA$, the required input resistance = ------.

Options :

1. ✔ 300 Ω

2. ✖ 150 Ω

3. ✖ 3 $K\Omega$

4. ✖ 900 Ω

Question Number : 34 Question Id : 7877322314 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an n −channel JFET. Suppose $I_{DSS} = 1.6\ mA$, $V_p = -3.6\ V$. The drain current for $V_{GS} = \frac{V_p}{4}$ is ----------.

Options :

1. ✔ 0.9 A

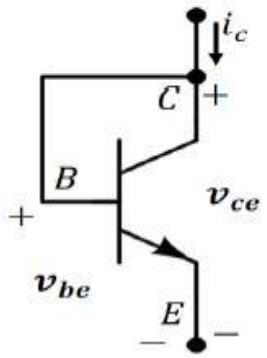
2. ✖ 0.45 A

3. ✖ $1.8\ A$

4. ✖ $2.7\ A$

Question Number : 35 Question Id : 7877322315 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a BJT small signal model. If the collector of the BJT is connected to the base terminal, the transistor continues to operate in the forward–active mode as shown in Figure. The small–signal resistance $r_e = \frac{v_{ce}}{i_e}$ of this two terminal device in terms of g_m, r_π, r_o is ----------.



Options :

1. ✖ $r_e = r_\pi \parallel (g_m + r_o)$

2. ✔ $r_e = r_\pi \parallel g_m \parallel r_o$

3. ✖ $r_e = r_\pi + (g_m \parallel r_o)$

4. ✖ $r_e = r_\pi\,(g_m \parallel r_o)$

Question Number : 36 Question Id : 7877322316 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Identify the filter from the following transfer function:

$$H(s) = \frac{2(s^2 + 1)}{(s^2 + 0.72\,s\, + 9)}.$$

Options :

1. ✖ Second-order lowpass

2. ✖ Second-order bandpass

3. ✖ Second-order highpass

4. ✔ Second-order notch

Question Number : 37 Question Id : 7877322317 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a bandpass active filter with a single Op Amp with the following specifications: $f_H = 3.5\,KHz$, and the bandwidth $\Delta f = 500\,Hz$. If the Q −factor is 6.5, $f_L \approx$ ----------.

Options :

1. ✖ $1\,KHz$

2. ✖ $2\,KHz$

3. ✔ $3\ KHz$

4. ✖ $4\ KHz$

Question Number : 38 Question Id : 7877322318 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the internal schematic of a 555 timer which of the following is *not* a building block of 555 timer?

Options :

1. ✖ Comparator

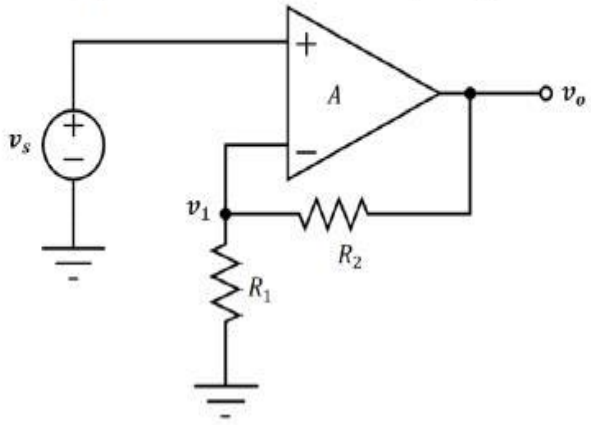
2. ✖ Flip-Flop

3. ✖ Power amplifier

4. ✔ Rectifier

Question Number : 39 Question Id : 7877322319 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the ideal Op Amp circuit shown in the Figure. Suppose $A = 2 \times 10^5$, $R_1 = 1\ K\Omega, R_2 = 9\ K\Omega, v_s = 1\ V$. The value of v_1 is equal to ----------.



Options :

1. ✔ $1\ V$

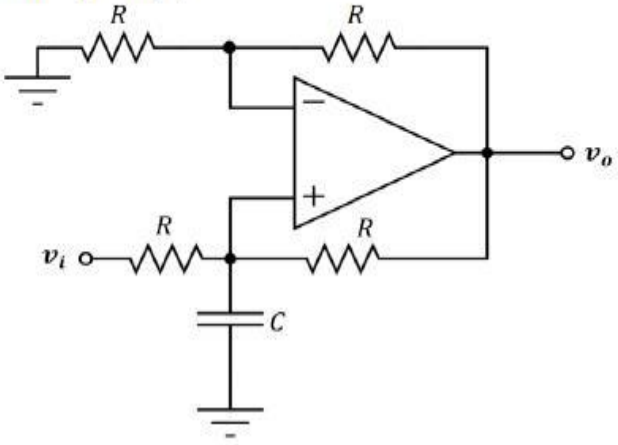
2. ✖ $0.5\ V$

3. ✖ $-1\ V$

4. ✖ $-0.5\ V$

Question Number : 40 Question Id : 7877322320 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 Op Amp circuit shown in the Figure. Suppose $R = 1\ M\Omega, C = 0.1\ \mu F$.
The output $v_o \approx \kappa \int v_i\, dt$. The value of κ is ----------.
(Note: Assume ideal Op Amp.).



Options :

1. ✖ 0.2

2. ✔ 20

3. ✖ 10

4. ✖ 0.1

Question Number : 41 Question Id : 7877322321 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Slew rate (SR) is the maximum rate at which the output can change. Suppose the SR of a $741C$ Op Amp is $0.5\ V/\mu s$. To complete a $9\ V$ output swing, the $741C$ voltage follower takes approximately ----------.

Options :

1. ✖ $0.45\ \mu s$

2. ✖ $0.9\ \mu s$

3. ✖ $9\ \mu s$

4. ✔ $18\ \mu s$

Question Number : 42 Question Id : 7877322322 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:
$f(A,B,C,D) = \overline{A + A\bar{B} + CD} + \bar{C} + \bar{D}.$
Which of the following is the right simplified function?

Options :

1. ✖ CD

2. ✔ $\bar{C} + \bar{D}$

3. ✖ $\bar{C}\bar{D}$

4. ✖ $C + D$

Question Number : 43 Question Id : 7877322323 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 product of maxterm, each one is a Boolean function.

$f(X,Y,Z) = (X+Y+Z)(X+Y+\bar{Z})(X+\bar{Y}+Z)(X+\bar{Y}+\bar{Z})(\bar{X}+\bar{Y}+Z)$.

Which of the following is valid?

Options :

1. ✖ $\sum M(0,1,2,3,7)$

2. ✖ $\sum M(1,2,3,6,7)$

3. ✖ $\Pi M(1,2,3,4,6)$

4. ✔ $\Pi M(0,1,2,3,6)$

Question Number : 44 Question Id : 7877322324 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a binary counter that counts from 0 to 1023. Suppose the counter is initially at zero. The count it will hold after 2090 pulses is ----------.

Options :

1. ✖ 40

2. ✔ 42

3. ✖ 41

4. ✖ 43

Question Number : 45 Question Id : 7877322325 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let the inherent propagation delay of each Flip-Flop is $\left(\frac{5}{3}\right) ns$. The maximum clock frequency of operation of the ripple counter that uses 6 Flip-Flops is -------.

Options :

1. ✔ $100\ MHz$

2. ✖ $50\ MHz$

3. ✖ $10\ MHz$

4. ✖ $1\ GHz$

Question Number : 46 Question Id : 7877322326 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 *not* an advantage of CMOS IC logic over TTL IC logic family?

Options :

1. ✖ Greater packing density

2. ✖ Greater fanout

3. ✔ Higher speed

4. ✖ Simpler fabrication

Question Number : 47 Question Id : 7877322327 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

An 8×1 MUX has inputs A, B, C connected to the select inputs S_2, S_1, S_0, respectively. The data inputs $d_0, \ldots, d_7$ are as follows:

$d_1 = d_2 = d_7 = 0;\ d_3 = d_5 = 1; d_0 = d_4 = D, d_6 = D'$. Which of the following is valid?

Options :

1. ✔ $f(A,B,C,D) = \sum m(1,6,7,9,10,11,12)$

2. ✖ $f(A,B,C,D) = \sum M(1,6,7,8,9,10,11)$

3. ✖ $f(A,B,C,D) = \sum m(1,6,7,8,9,11,12)$

4. ✖ $f(A,B,C,D) = \sum M(1,6,7,8,9,11,12)$

Question Number : 48 Question Id : 7877322328 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A combinational circuit compares two 2−bit numbers to check if they are equal.

The circuit output is equal to 1 if the two numbers are equal, and, 0, otherwise.

The Boolean function associated with the combinational circuit is ----------.

Options :

1. ✖ $(A_0 \oplus B_0)(A_1 \oplus B_1)$

2. ✖ $(A_0 \oplus B_0)+(A_1 \oplus B_1)$

3. ✔ $(A_0 \oplus B_0)'\,(A_1 \oplus B_1)'$

4. ✖ $(A_0 \oplus B_0)'(A_1 \oplus B_1)$

Question Number : 49 Question Id : 7877322329 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 table provides the values of Flip-Flop inputs for a given state transition?

Options :

1. ✖ State table

2. ✖ Characteristic table

3. ✔ Excitation table

4. ✖ Truth table

Question Number : 50 Question Id : 7877322330 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The successive approximation technique (SAT) uses a very efficient code search strategy to complete an n−bit conversion in just n −clock periods. Consider a SAT based ADC which is 12 −bit converter with frequency of 1 MHz. It can perform approximately ---------- conversions per second.

Options :

1. ✖ 16,667

2. ✔ 83,333

3. ✖ 8,333

4. ✖ 1,667

Question Number : 51 Question Id : 7877322331 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 characteristic equation for the complement output of a JK Flip-Flop?

Options :

1. ✔ $Q'(n+1) = J'Q' + K\,Q$

2. ✖

$Q'(n+1) = JQ' + K'Q$

3. ✖ $Q'(n+1) = J'Q' + K'Q'$

4. ✖ $Q'(n+1) = JQ + K\,Q'$

Question Number : 52 Question Id : 7877322332 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the 8085 microprocessor's registers. Which of the following refers to the program status word (PSW)?

Options :

1. ✖ Flags and Stack Pointer

2. ✔ Flags and Accumulator

3. ✖ Any general purpose register with flags

4. ✖ Program counter and flags

Question Number : 53 Question Id : 7877322333 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose in 8085 microprocessor register A contains 29 (in BCD), register B contains 33 (in BCD), and the carry flag is 1. Consider the following set of instructions:

$$ADC\ B$$
$$DAA$$

Which of the following is valid?

Options :

1. ✖ The register A contains 62

2. ✔ The register A contains 63

3. ✖ The register A contains 0

4. ✖ No effect on the registers

Question Number : 54 Question Id : 7877322334 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the 8085 microprocessor instruction set to perform the following. Suppose we need to reverse the value of the carry flag without disturbing the values of the other flags. Which of the following instruction(s) will do the job?

Options :

1. ✖ STC

2. ✖ CMC

3.

CMC

✖ STC

STC

4. ✔ CMC

Question Number : 55 Question Id : 7877322335 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The simplified expression of

$\int_{-1}^{+1} \{\cos\left(t^2 + \frac{\pi}{2}\right) + e^{-3t}\}\ \delta(t)\ dt =$ ----------.

(Note: $\delta(t)$ denotes the unit impulse function.).

Options :

1. ✖ 0

2. ✖ 3

3. ✔ 1

4. ✖ π

Question Number : 56 Question Id : 7877322336 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the impulse response $h(t) = (2e^{-t} - 1)\delta(t)$. Let $y(t)$ denote the system's response. Suppose input $x(t) = e^{-3t}\,u(t)$ is applied, the energy of the output $y(t)$ is ----------. (Note: $u(t)$ denotes the unit step function.).

Options :

1. ✔ $\frac{1}{9}$

2. ✖ $\frac{1}{3}$

3. ✖ $\frac{1}{18}$

4. ✖ $\frac{2}{3}$

Question Number : 57 Question Id : 7877322337 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $x[n] = b^n u[n-1], 0 < |b| < 1$, and $X(\Omega)$ denote its discrete-time Fourier transform. The phase of $\frac{1}{X(\Omega)}$ when $\Omega = \cos^{-1}(b)$ is ----------.

(Note: $u(t)$ denotes the unit step sequence.).

Options :

1. ✖ π

2.

✔ $\frac{\pi}{2}$

3. ✖ $\frac{\pi}{3}$

4. ✖ 0

Question Number : 58 Question Id : 7877322338 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The impulse response of an ideal discrete-time lowpass filter $h_{LP}[n] = \frac{\omega_c}{n} sinc[\omega_c n]$, where $sinc(.)$ denotes the function $sinc[m] = \frac{\sin[\pi m]}{\pi m}$. The frequency response of $(-1)^n h_{LP}[n]$ for $\omega_c = 0.5$ is $rect[\omega - \omega_0]$. The value of ω_0 is ----------.

Options :

1. ✖ 2π

2. ✖ $\frac{\pi}{2}$

3. ✔ π

4. ✖ $-\pi$

Question Number : 59 Question Id : 7877322339 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose $x[n] = \frac{1}{n} e^{j\pi(n+1)} u[n-1]$. Let $Y(z) = z\, e^{X(z)}, |z| > 1$.

Which of the following is valid?

Options :

1. ✔ $Y(z) = z + 1$

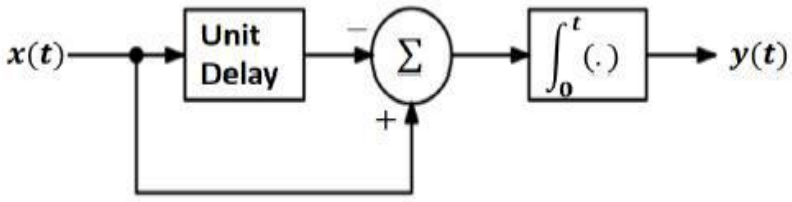
2. ✖ $Y(z) = z$

3. ✖ $Y(z) = z^{-1}$

4. ✖ $Y(z) = z - 1$

Question Number : 60 Question Id : 7877322340 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the block diagram depicted in the figure. Let $h(t)$ is the impulse response and $H(f)$ is its continuous-time Fourier transform. The value $H(0)$ = --------.



Options :

1. ✖ 2

2. ✖ 0.5

3. ✖ 0.25

4. ✔ 1

Question Number : 61 Question Id : 7877322341 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose $x(t) = 2\sin(400\,\pi t) + \sin(200\,\pi t)$ and $y(t) = x(t)\sin^2(400\,\pi t)$. If $y(t)$ is passed through an ideal lowpass filter with cut-off frequency of 360π and passband gain of 2, the output signal is ----------.

Options :

1. ✖ $0.5\sin(200\,\pi t)$

2. ✔ $\sin(200\,\pi t)$

3. ✖ $2\sin(100\,\pi t)$

4. ✖ $0.25\sin(200\,\pi t)$

Question Number : 62 Question Id : 7877322342 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction

Time : 0

Let $Q(z) = \frac{0.5}{(1-0.75\,z^{-1}+0.125\,z^{-2})}, |z| > 0.5$. The inverse Z –transform is of the form $q[n] = \{a^n - a\,(b)^n\}\,u[n]$. The values of a and b are, respectively, -------- and --------.

Options :

1. ✖ $0.75, 0.25$

2. ✖ $0.5, 0.75$

3. ✖ $0.5, 0.5$

4. ✔ $0.5, 0.25$

Question Number : 63 Question Id : 7877322343 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the comparison of 8 –point DFT and 8 –point FFT. Assuming a sequence of eight distinct complex numbers of the form $(a + bj), a \neq 0, b \neq 0$. The approximate ratio of total number of operations (additions and multiplications) required for DFT to that of FFT is ----------.

Options :

1. ✖ 1.33

2. ✖ 2.33

3.

✔ 3.33

4. ✖ 1.0

Question Number : 64 Question Id : 7877322344 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 transfer function: $X(s) = \frac{1}{1-e^{-(1+s)}}$.

All the poles lie on a vertical line passing through ---------.

Suppose the signal is right-sided. The region of convergence is ----------.

Options :

1. ✔ $s = -1; \Re\{s\} > -1.$

2. ✖ $s = -1; \Re\{s\} > 1.$

3. ✖ $s = 1; \Re\{s\} > -1.$

4. ✖ $s = 1; \Re\{s\} > 1.$

Question Number : 65 Question Id : 7877322345 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 frequency response for a causal and stable LTI system:

$H(j\omega) = \frac{1-j\omega}{1+j\omega}$. The phase $\angle H(j\omega)$ at $\omega = 1$ radian is ----------.

Options :

1. ✖ π

2. ✖ $\frac{\pi}{2}$

3. ✔ $-\frac{\pi}{2}$

4. ✖ $-\pi$

Question Number : 66 Question Id : 7877322346 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a continuous-time causal and stable LTI system characterized by the following linear constant coefficient differential equation: $\frac{dy(t)}{dt} + 9y(t) = 2\,x(t)$.

Let $s(t)$ denote the step response. Suppose $\frac{s(t_0)}{s(\infty)} = \frac{e^2-1}{e^2}$. The value of t_0 is -------.

Options :

1. ✖ $\frac{1}{9}$

2. ✔ $\frac{2}{9}$

3. ✖ $\frac{9}{2}$

4. ✖ $\frac{4}{9}$

Question Number : 67 Question Id : 7877322347 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a causal LTI system whose frequency response is $H(e^{j\omega}) = e^{-j\omega}\left\{\frac{(2-e^{j\omega})}{(2-e^{-j\omega})}\right\}$. The group delay $\tau(\omega)$ can be expressed as $\frac{k}{(a+b\cos\omega)}$, where $(k, a, b) =$ ----------.

Options :

1. ✔ $(3,5,-4)$

2. ✖ $(3,-4,5)$

3. ✖ $(4,-3,5)$

4. ✖ $(-3,5,4)$

Question Number : 68 Question Id : 7877322348 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $x(t) = \frac{d}{dt}\left\{\frac{2}{9} rect\left(\frac{t}{9}\right)\right\}$. The continuous-time Fourier transform of $y(t) = \int_{-\infty}^{t} x(\tau)\, d\tau$ is ----------. (Note: $sinc(.)$ denotes the function $sinc(\psi) = \frac{\sin(\pi\psi)}{\pi\psi}$.).

Options :

1. ✔ $2\sin\left(\frac{9}{2}\omega\right)$

2. ✖ $4\sin(9\omega)$

3. ✖ $2\sin\left(\frac{2}{9}\omega\right)$

4. ✖ $\sin\left(\frac{2}{9}\omega\right)$

Question Number : 69 Question Id : 7877322349 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a control system model whose transfer function is given by $\frac{Y(s)}{X(s)} = \frac{100}{s^2+100}$. Suppose the input is $r(t) = 9\,u(t)$, where $u(t)$ is the unit-step function. The output is of the form $a + b\cos(ct)$. The values $a, b,$ and, c, respectively, are -----, -------, and, ------.

Options :

1. ✖ $-9, 9, 100$

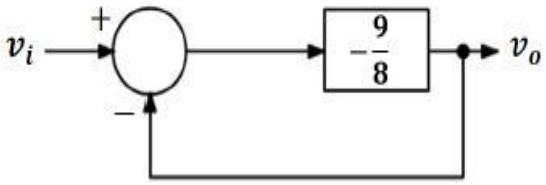
2. ✔ $9, -9, 10$

3. ✖ $9, -10, 10$

4. ✖ $9, -10, 100$

Question Number : 70 Question Id : 7877322350 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the block diagram shown in Figure. The input−output relationship in its simplified version is given by $v_o = G\, v_i$. The value of G is ----------.



Options :

1. ✖ $\frac{1}{8}$

2. ✖ $\frac{8}{9}$

3. ✖ $\frac{1}{9}$

4. ✔ 9

Question Number : 71 Question Id : 7877322351 Display Question Number : Yes Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A system has the characteristic function $s^3 + p\,s^2 + q\,s + r = 0$. Suppose that $p > 0$ and $r > 0$. The range of the values of q that will make the system stable one is given by ----------.

Options :

1. ✔ $q > \frac{r}{p}$

2. ✖ $q > \frac{p}{r}$

3. ✖ $q > rp$

4. ✖ $0 < q < rp$

Question Number : 72 Question Id : 7877322352 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 expression for the closed−loop transfer function: $\frac{10}{s^2+2s+10}$. At what angular frequency does the output oscillate in responding to a step command before reaching steady state?

Options :

1. ✖ $1\,rad/s$

2. ✖ $2\,rad/s$

3. ✖ $9\,rad/s$

4. ✔ $3\,rad/s$

Question Number : 73 Question Id : 7877322353 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 system:

$\ddot{x} + 3\,\dot{x} + 2\,x = \delta(t) + \dot{\delta}(t)$. The initial conditions: $x(0-) = 1, \dot{x}(0-) = 2$.

Which of the following is valid? (Note: $\ddot{x}$ denote the second derivative, $\dot{x}$ denotes the first derivative with respect to time. Further, $L\{\dot{\delta}(t)\} = s$.).

Options :

1. ✖ $x(t) = 4e^{-2t} - 2e^{-t}, t > 0$

2. ✔ $x(t) = 4e^{-t} - 2e^{-2t}, t > 0$

3. ✖ $x(t) = 2e^{-t} - 4e^{-2t}, t > 0$

4. ✖ $x(t) = 2e^{-2t} - 4e^{-t}, t > 0$

Question Number : 74 Question Id : 7877322354 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the state transition matrix $(STM)\ \phi(t) = e^{At}$. Suppose $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$.

The determinant of the STM is ----------.

Options :

1. ✖ e^{t}

2. ✖ e^{-t}

3. ✔ e^{2t}

4. ✖ e^{-2t}

Question Number : 75 Question Id : 7877322355 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 feedback system with the forward path function $G(s) = \frac{s+1}{s^2+s+1}$. Further, the system function of the feedback path is $H(s) = 1$. The phase margin is ----------.

Options :

1. ✖ $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

2. ✔ $2\tan^{-1}\sqrt{2}$

3. ✖

$0.5 \tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

$0.5 \tan^{-1}\sqrt{2}$

4. ✖

Question Number : 76 Question Id : 7877322356 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The differential equation of a linear system is given by

$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6\,y(t) = r(t)$, where $y(t)$ is the output and $r(t)$ is the input.

Let $r(t) = u(t)$. The final value of $y(t)$ is ----------.

Options :

1. ✖ $\frac{1}{2}$

2. ✖ $\frac{1}{3}$

3. ✔ $\frac{1}{6}$

4. ✖ $\frac{5}{6}$

Question Number : 77 Question Id : 7877322357 Display Question Number : Yes Is Question

Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The rise time is the time that unit step response reaches from 0.1 to 0.9. Consider the first order system $H(s) = \frac{1}{9s+1}$. The approximate rise time t_r of the system is

Options :

1. ✖ $10\ s$

2. ✔ $20\ s$

3. ✖ $1\ s$

4. ✖ $2\ s$

Question Number : 78 Question Id : 7877322358 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The state equation of a LTI system is given by $\ddot{x}(t) = A\,x(t) + B\,u(t)$.

Suppose $A = \begin{bmatrix} 0 & 1 \\ -4 & -5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$. The characteristic equation is ----------.

Options :

1. ✖ $s^2 + 4s + 5 = 0$

2. ✔ $s^2 + 5s + 4 = 0$

3. ✖

$s^2 - 4s + 5 = 0$

4. ✖ $s^2 + 4s - 5 = 0$

Question Number : 79 Question Id : 7877322359 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the open loop transfer function $\frac{6}{s(1+s)(3+s)}$. The magnitude (in dB) when $\omega = \sqrt{3}\, rad/s$ is approximately ----------. (Note: $\log_{10} 2 \approx 0.3$)

Options :

1. ✔ $-6\ dB$

2. ✖ $0\ dB$

3. ✖ $-3\ dB$

4. ✖ $6\ dB$

Question Number : 80 Question Id : 7877322360 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider lead compensator transfer function $H(s) = \frac{s+a}{s+b}, a < b$. Let $a = 4, b = 9$. The magnitude of attenuation produced by a lead compensator at the frequency of the maximum phase lead $\omega_m = \sqrt{ab}$ is approximately --------

Options :

1. ✔ 0.67

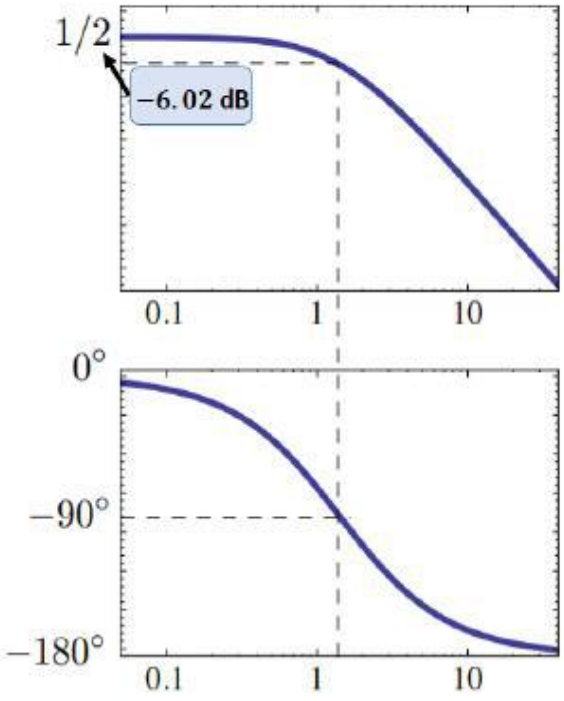
2. ✖ 0.33

3. ✖ 0.16

4. ✖ 0.50

Question Number : 81 Question Id : 7877322361 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

For the Bode plot shown in Figure, which of the following is valid?



Options :

1. ✖ $\frac{1}{s+2}$

2. ✔ $\frac{1}{(s+1)(s+2)}$

3. ✖ $\frac{(s+1)}{(s+2)}$

4. ✖ $\frac{1}{(s^2+1)}$

Question Number : 82 Question Id : 7877322362 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider $GH(s) = \frac{k(s+4)}{s^2(s+6)}$. The centre of asymptotes for $GH(s)$ is located at -----.

(Note: Use Root-loci concept.).

Options :

1. ✖ -2

2. ✖ -4

3. ✔ -1

4. ✖ -3

Question Number : 83 Question Id : 7877322363 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 probability density function

$p(y) = ky\{u(y) - u(y - 2.5)\}$, where $u(.)$ denotes the unit−step function.

The value of k is ----------.

Options :

1. ✖ $\frac{2}{25}$

2. ✔ $\frac{8}{25}$

3. ✖ $\frac{4}{25}$

4. ✖ $\frac{6}{25}$

Question Number : 84 Question Id : 7877322364 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Let $S_X(\omega)$ is the power spectral density (PSD) of the stationary random process $X(t)$. Suppose $Y(t+T) = X(t+T) - X(t)$. The ratio $\frac{S_Y(\omega)+S_X(\omega)}{S_Y(\omega)-S_X(\omega)}$ when $\omega = \frac{\pi}{T}$ is ---------- (Note: $S_Y(\omega)$ is the PSD of the stationary random process $Y(t)$.).

Options :

1. ✔ $\frac{5}{3}$

2. ✖ $\frac{15}{3}$

3. ✖ $\frac{3}{5}$

4. ✖ $\frac{1}{5}$

Question Number : 85 Question Id : 7877322365 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The approximate root mean square (RMS) voltage due to thermal noise in two series resistors $100\ \Omega$ and $150\ \Omega$, at $T = 290°K$ is ---------- (Note: Assume bandwidth of $10^6\ Hz$, Boltzmann constant $\kappa = 1.38 \times 10^{-23}\ J/°K$.).

Options :

1. ✖ $1\ \mu V$

2. ✔ $2\ \mu V$

3. ✖ $4\ \mu V$

4. ✖ $8\ \mu V$

Question Number : 86 Question Id : 7877322366 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 AM broadcast station transmits an average carrier power output of 1 KW and uses a modulation index of 0.63. The peak amplitude of the output if the antenna is represented by a 20 Ω resistive load is ----------.

Options :

1. ✖ $163\ V$

2. ✖ $652\ V$

3. ✖ $226\ V$

4. ✔ $326\ V$

Question Number : 87 Question Id : 7877322367 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose a 10 MHz carrier is frequency modulated (FM) by a sinusoidal signal such that the peak frequency deviation is 49 KHz. Suppose the modulating signal is single tone of frequency 245 KHz. The approximate bandwidth of the FM signal is ----------. (Note: Compute the bandwidth after finding modulation index.).

Options :

1. ✔ $0.490\ MHz$

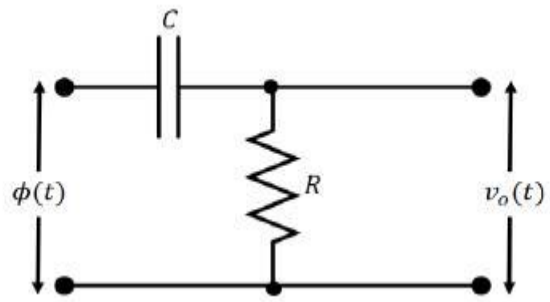
2. ✖ $0.980\ MHz$

3. ✖ $1.960\ MHz$

4. ✖ $0.245\ MHz$

Question Number : 88 Question Id : 7877322368 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose an angle modulated signal $\phi(t)$ is applied to the input of a passive RC filter as shown in the Figure. Let $R = 1\,M\Omega, C = 0.1\,\mu F$. If $\omega \ll \frac{1}{RC}$, in the frequency band occupied by $\phi(t)$, the channel impulse response $h(t)$ is approximately ----------.



Options :

1.

1. ✖ $h(t) \approx \frac{d}{dt}$

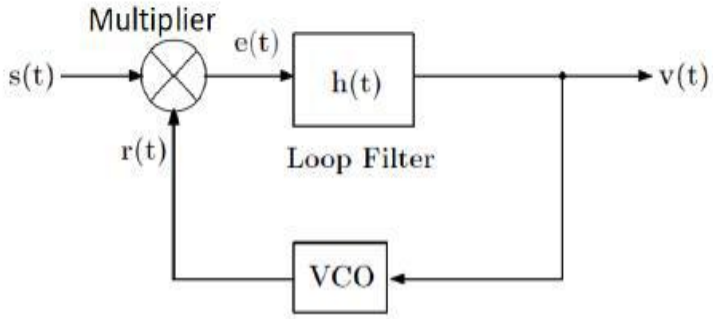
2. ✖ $h(t) \approx 10\frac{d}{dt}$

3. ✔ $h(t) \approx 0.1\frac{d}{dt}$

4. ✖ $h(t) \approx 0.01\frac{d}{dt}$

Question Number : 89 Question Id : 7877322369 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the block diagram of a phase locked loop (PLL) shown. In it, the inputs to the multiplier (whose gain is $2k_m\ volt^{-1}$) are given by the following: $s(t) = \sin(2\pi f_c t + \phi_1(t))$ and $r(t) = \cos(2\pi f_c t + \phi_2(t))$, where $\phi_2(t) = 2\pi k_v \int_0^t v(\tau)\, d\tau$. Let $\phi_e(t) = \phi_1(t) - \phi_2(t)$. The integro-differential equation is given by $\frac{1}{2\pi}\frac{d\phi_2(t)}{dt} = K \sin(\phi_e(t)) * h(t)$, where $*$ denotes the convolution. The constant K = ----------. (Note: Do *not* use $\sin\theta \approx \theta$ approximation.).



Options :

1. ✖

$\frac{k_v}{k_m}$

2. ✔ $k_v k_m$

3. ✖ $\sqrt{k_v k_m}$

4. ✖ $\frac{k_m}{k_v}$

Question Number : 90 Question Id : 7877322370 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider an AM broadcast superheterodyne receiver with IF, RF, and local oscillator frequencies denoted by f_{IF}, f_c, f_{lo}. Let $\rho = \frac{f_{si}}{f_c} - \frac{f_c}{f_{si}} \approx 1.5$, where f_{si} denotes the image frequency. The quality factor in terms of image rejection ratio β is given by ---------- (Note: Assume $Q\rho \gg 1$.).

Options :

1. ✔ $Q \approx \frac{2\beta}{3}$

2. ✖ $Q \approx \frac{\beta}{3}$

3. ✖

$Q \approx \frac{3\beta}{2}$

4. ✖ $Q \approx \frac{\beta}{2}$

Question Number : 91 Question Id : 7877322371 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a finite energy signal $s(t) = \begin{cases} 4t^2, & 0 \le t \le 1, \\ 0, & o.w. \end{cases}$
Suppose that the signal $s(t)$ is applied to a matched filter (MF) whose impulse response is matched to $s(t)$. Assuming additive white Gaussian noise (AWGN) of zero mean and two-sided PSD of $10^{-15}\ W/Hz$. The maximum SNR (in dB) at the MF output is ----------.

Options :

1. ✖ $13\ dB$

2. ✔ $23\ dB$

3. ✖ $26\ dB$

4. ✖ $16\ dB$

Question Number : 92 Question Id : 7877322372 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 codes for information processing: i) Hamming code, ii) Shannon-Fano code, iii) Huffman code, and iv) Convolutional code. Which of the above codes are used for source coding?

Options :

1. ✖ $(i), (ii)$ and (iii)

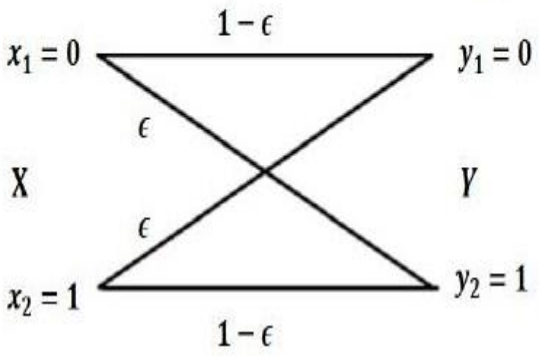
2. ✖ (i) and (iv)

3. ✔ (ii) and (iii)

4. ✖ (iv) only

Question Number : 93 Question Id : 7877322373 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the binary symmetric channel (BSC) shown in the figure with crossover probability ϵ. Suppose $P_X(0) = 0.4$ and $P_X(1) = 0.6$. The probability $P_{(X|Y)}(1|1)$ when $\epsilon = 0.1$ is ----------.



Options :

1. ✔

$\frac{27}{29}$

2. $\frac{12}{29}$

3. $\frac{17}{29}$

4. $\frac{15}{29}$

Question Number : 94 Question Id : 7877322374 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a signal constellation of four symbols $s_1\left(\sqrt{E_s}, 0\right), s_2\left(0, \sqrt{E_s}\right), s_3\left(-\sqrt{E_s}, 0\right), s_4\left(0, -\sqrt{E_s}\right)$. If the average energy per symbol is $10^{-12} J$ and two−sided AWGN PSD is $10^{-13}\ W/Hz$. The approximate value of $\frac{E_s}{N_0}$ is ---------- (Note: $\log_{10} 2 \approx 0.3$.).

Options :

1. $3\ dB$

2. $10\ dB$

3. $5\ dB$

4. ✔ $7\ dB$

Question Number : 95 Question Id : 7877322375 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 linear block code:

$C_0 = [0\ 0\ 0\ 0\ 0\ ],\ C_1 = [0\ 1\ 0\ 1\ 1],\ C_2 = [1\ 0\ 1\ 0\ 1], C_3 = [1\ 1\ 1\ 1\ 0].$

The number of parity bits in the block code is ----------.

Options :

1. ✖ 1

2. ✖ 2

3. ✔ 3

4. ✖ 4

Question Number : 96 Question Id : 7877322376 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a TDMA cellular system service area approximated using hexagonally shaped cells with reuse factor 21. Let the total cellular system bandwidth is 42 MHz and the required bandwidth is 100 KHz. The user capacity (number of users per cell) that can be accommodated is ----------.

Options :

1. ✖ 10

2. ✔ 20

3. ✖ 40

4. ✖ 200

Question Number : 97 Question Id : 7877322377 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose the volume charge density $\rho_v = (0.125)\, e^{-|x|-|y|-|z|}$, which exists over all free space. The total charge present is ----------.

Options :

1. ✔ $1\ C$

2. ✖ $2\ C$

3. ✖ $4\ C$

4. ✖ $8\ C$

Question Number : 98 Question Id : 7877322378 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction

Time : 0

A cube whose faces are parallel to the Cartesian coordinate surfaces is located (centred) at $Q(3,-2,4)$. Suppose the field $D = 2y^3\ \hat{a}_y\ C/m^3$. The value of $div\ D$ at Q is ----------.

Options :

1. ✖ $6\ C/m^3$

2. ✖ $12\frac{C}{m^3}$

3. ✔ $24\frac{C}{m^3}$

4. ✖ $48\ C/m^3$

Question Number : 99 Question Id : 7877322379 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 uniform plane wave travelling in vacuum characterized by $\bar{E} = (\hat{a}_x + \hat{a}_y)e^{-jkz}$. Which of the following is a valid statement?

Options :

1. ✖ Right circular polarization

2. ✖ Left circular polarization

3. ✖ Linear polarization at an angle of 180° from the $\hat{a}_x$ axis

4. ✔ Linear polarization at an angle of 45° from the $\hat{a}_x$ axis

Question Number : 100 Question Id : 7877322380 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Two uniform plane waves of different strengths are travelling in opposite direction and are super imposed as follows: $E = \hat{a}_x \left(e^{-jkz} + \frac{1}{3}e^{-jkz}\right)$. The average power associated with the combination is given by ----------.

(Note: Assume wave propagation in free space.).

Options :

1. ✖ $\frac{1}{9\,\eta_o}\hat{a}_z$

2. ✖ $\frac{2}{9\,\eta_o}\hat{a}_z$

3. ✖ $\frac{1}{3\,\eta_o}\hat{a}_z$

4. ✔ $\frac{4}{9\,\eta_o}\hat{a}_z$

Question Number : 101 Question Id : 7877322381 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose the electric field of a uniform electromagnetic (EM) plane wave in free space is given by $E = 100(\hat{a}_y + j\,\hat{a}_z)e^{-j12\pi x}$. The frequency of the EM wave is ----------.

Options :

1. ✖ $0.9\ GHz$

2. ✔ $1.8\ GHz$

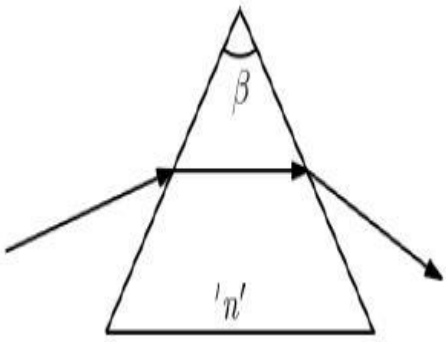
3. ✖ $3.6\ GHz$

4. ✖ $2.4\ GHz$

Question Number : 102 Question Id : 7877322382 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider the Brewster prism shown in the Figure. For the s –polarized light, fraction of incident power that is transmitted through the prism is ----------.

(Note: The power transmission coefficient through each surface is $1 - |\Gamma|^2$, where $|\Gamma| = \frac{1-n^2}{1+n^2}$, where 'n' denotes the refractive index.).



Options :

1. ✔

$$\frac{16n^4}{(n^2+1)^4}$$

2. ✖ $$\frac{4n^2}{(n^2+1)^2}$$

3. ✖ $$\frac{4(n^2-1)^4}{(n^2+1)^4}$$

4. ✖ $$\frac{16(n^2-1)^2}{(n^2+1)^2}$$

Question Number : 103 Question Id : 7877322383 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A coaxial cable is to be used for a community CATV for frequencies up to 0.4 GHz.

If $\epsilon = 4\epsilon_0, \mu = \mu_0, a = 0.5\ mm, b = 1\ mm.$ The lossless characteristic impedance of the coaxial cable is ----------

(Note: $L = \frac{\mu}{2\pi}\ln\left(\frac{b}{a}\right)$, $C = \frac{2\pi\epsilon}{\ln\left(\frac{b}{a}\right)}$, $\sqrt{\frac{\mu_0}{\epsilon_0}} = 120\pi$; $\ln 2 \approx 0.693$.).

Options :

1. ✖ $7\ \Omega$

2. ✖ $14\ \Omega$

3. ✔ $21\ \Omega$

4. ✖ $42\ \Omega$

Question Number : 104 Question Id : 7877322384 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A certain transmission line has characteristic impedance of z_0 and is terminated in a load impedance of z_ℓ. The ratio $\frac{z_0}{z_\ell}$ in term of its reflection coefficient Γ and its transmission coefficient T is given by ----------.

Options :

1. ✖ $1-\left(\frac{T}{\Gamma}\right)$

2. ✖ $1+\left(\frac{T}{\Gamma}\right)$

3. ✖ $1+\left(\frac{\Gamma}{T}\right)$

4. ✔ $1-\left(\frac{2\Gamma}{T}\right)$

Question Number : 105 Question Id : 7877322385 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A lossless transmission line has a characteristic impedance of 100 Ω and is terminated in a load resistance of 150 Ω. The transmission line is energized by a generator having output impedance of 100 Ω. Suppose the magnitude of the instantaneous load voltage is 40 V, then the open-circuit output (RMS) voltage is

Options :

1. ✔ $32\ V$

2. ✖ $16\ V$

3. ✖ $20\ V$

4. ✖ $24\ V$

Question Number : 106 Question Id : 7877322386 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Over a certain frequency range, the refractive index of a certain material varies approximately linearly with frequency as $\eta(\omega) = 1.45 + (1.5)(\omega - k)$, where k is real positive constant. The group velocity dispersion parameter is ----------.

(Note: $\beta = \frac{\eta(\omega)\,\omega}{c}$, where $c = 3 \times 10^8\ m/s$.).

Options :

1. ✖ 10^{-18}

2. ✔ 10^{-8}

3. ✖ 10^{-9}

4. ✖ 10^{-4}

Question Number : 107 Question Id : 7877322387 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A parallel plate guide is to be constructed for operation in the transverse electromagnetic field (TEM) mode only over the frequency range $0 < f < 3.5\ GHz$. The maximum allowable plate separation is 3 cm. The dielectric between plates has dielectric constant approximately equal to ----------.

(Note: Maximum plate separation is inversely proportional to: i) the maximum frequency of operation and ii) the square root of the dielectric constant.).

Options :

1. ✔ 2

2. ✖ 4

3. ✖ 0.2

4. ✖ 0.4

Question Number : 108 Question Id : 7877322388 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

A short current element has length $d = \frac{\lambda}{4\pi}$.

Assuming uniform current distribution, the radiation resistance is ----------.

Options :

1. ✖ 10 Ω

2. ✖ 20 Ω

3. ✔ 5 Ω

4. ✖ 15 Ω

Question Number : 109 Question Id : 7877322389 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Suppose a uniform plane electromagnetic wave has axial ratio (AR) of 3, then the circular-depolarization ratio is ----------.

(Note: AR is the ratio of the major to minor axes of the polarization ellipse.).

Options :

1. ✖ 0.25

2. ✔ 0.5

3. ✖ 0.75

4. ✖ 1.25

Question Number : 110 Question Id : 7877322390 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 power source with the following power pattern:

$U = U_{max} \cos^8 \theta, \quad 0 \leq \theta \leq \frac{\pi}{2}$. The directivity $D =$ ----------.

Options :

1. ✖ 9

2. ✖ 6

3. ✖ 3

4. ✔ 18

Question Number : 111 Question Id : 7877322391 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Consider a non-singular 2 X 2 square matrix A. If trace(A) = 4 and trace(A^2) =4,

the determinant of the matrix A is

Options :

1. ✖ 2

2. ✖ 4

3. ✔ 6

4. ✖ 8

Question Number : 112 Question Id : 7877322392 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, b the following equations $x + 2y + z = 8$, $2x + y + 3z = 13$, $3x + 4y - az = b$ have no solutions.

Options :

1. ✖ $a = 1/3, b \neq 22$

2. ✖ $a = -1/3, b \neq 22$

3. ✖ $a = 11/3, b \neq 22$

4. ✔ $a = -11/3, b \neq 22$

Question Number : 113 Question Id : 7877322393 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 $\iint y\,dx\,dy$, where the domain bounded by y-axis, the curve $y = x^2$ and the line $x + y = 2$ in the first quadrant is

Options :

1. ✖ $\frac{15}{16}$

2. ✔ $\frac{16}{15}$

3. ✖ $\frac{6}{5}$

4. ✖ $\frac{5}{6}$

Question Number : 114 Question Id : 7877322394 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $\bar{r} = x\,i + yj + zk$ then, $\nabla\left(\frac{1}{r}\right) =$

Options :

1. ✔ $-\frac{\bar{r}}{r^3}$

2. ✖ $\frac{\bar{r}}{r^3}$

3. ✖

$\frac{\bar{r}}{r^2}$

4. ✖ $-\frac{\bar{r}}{r^2}$

Question Number : 115 Question Id : 7877322395 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The general solution of $(x + 2y^3)\frac{dy}{dx} = y$ is

Options :

1. ✖ $y = x^2 + C\,x$

2. ✖ $y = x^3 + C\,x$

3. ✔ $x = y^3 + C\,y$

4. ✖ $x = y^2 + C\,y$

Question Number : 116 Question Id : 7877322396 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

The general solution of $x^2\frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = 0$

Options :

1. ✖ $y = C_1x^{-1} + C_2x$

2. ✖ $y = C_1x + C_2x^2$

3. ✖ $y = C_1x^{-2} + C_2x^{-3}$

4. ✔ $y = C_1x^{-1} + C_2x^{-2}$

Question Number : 117 Question Id : 7877322397 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 $\oint_C \frac{e^z}{z^2+1}\,dz$, where $C : |z| = 1$ *is*

Options :

1. ✖ $2\pi\left(e^i - e^{-i}\right)$

2. ✖ $\pi\left(e^i + e^{-i}\right)$

3. ✔ $\pi\left(e^i - e^{-i}\right)$

4. ✖

$$-\pi\left(e^{i}-e^{-i}\right)$$

Question Number : 118 Question Id : 7877322398 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $f(z)=\frac{z+1}{z^2\,(z-2)}$, then the residue at z = 0 is

Options :

1. ✖ $\frac{3}{4}$

2. ✔ $-\frac{3}{4}$

3. ✖ $-\frac{1}{4}$

4. ✖ $\frac{1}{4}$

Question Number : 119 Question Id : 7877322399 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

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

Options :

1. ✔ 6

2. ✖ 4

3. ✖ 2

4. ✖ 1

Question Number : 120 Question Id : 7877322400 Display Question Number : Yes Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

If $\frac{dy}{dx} = x - y$ and $y(0) = 1$ then Picard's method the value of $y^{(1)}(1)$ is

Options :

1. ✖ 3.905

2. ✖ 2.905

3. ✖ 1.905

4. ✔ 0.905