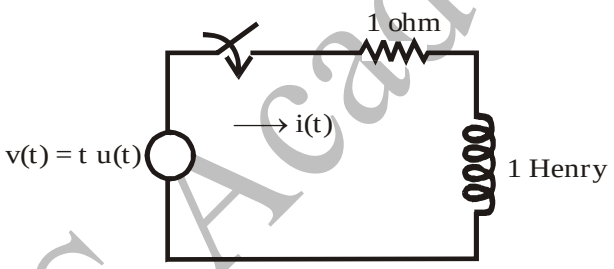
Question Paper of Engineering Service Examination 2010 Electronics and Telecommunication Engineering Paper-I

Objective

1.



The current in the above network is

(a) $|t - 1 + e^{-t}|\ u(t)$ (b) $|t^2 - t + e^{-t}|\ u(t)$

(c) $|t + 1 + e^{-t}|\ u(t)$ (d) $|t - 1 - e^{-t}|\ u(t)$

2. **When waves travel along a transmission line from a generator to a load, through which region is power transmission taking place?**

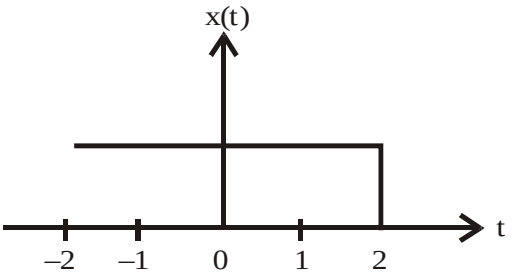
(a) Only through the conducting region

(b) Only through the non-conducting regions

(c) Both through conducting and non-conducting regions

(d) Through the conducting regions for half a cycle and through the non-conducting regions for the next half cycle.

3.



The mathematical model of the above shown signal is
(a) x(t) = u (2 + t)
(b) x(t) = u(t – 2)
(c) x(t) = u (2 – t)
(d) x(t) = u(t – 1)

4. Consider the following statements:
1. Power factor will be unity.
2. Current in circuit will be maximum.
3. Current in circuit will be minimum.
Which of these statements are correct with respect to resonance in R-L-C parallel circuit?
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1 and 3 only

5. Number of state variables of discrete time system, described by
$y[n] - \frac{3}{4} y[n-1] + \frac{1}{8} y[n-2] = x[n]$ is
(a) 2
(b) 3
(c) 4
(d) 1

6. Which of the following pair of values of L and C should be used in a tank circuit to obtain a resonant frequency of 8 kHz? The bandwidth is 800 Hz and winding resistance of the coil is 10 ohms.
(a) 2 mH and 1 μF
(b) 10 H and 0.2 μF
(c) 1.99 mH and 0.2 μF
(d) 1.99 mH and 10 μF

7. An elliptically polarized wave traveling in the positive Z-direction in air has x and y components
$E_X = 3 \sin(\omega t - \beta)$ V/m
$E_Y = 6 \sin(\omega t - \beta z + 75^\circ)$ V/m
If the characteristic impedance of air is 360 Ω, the average power per unit area conveyed by the wave is
(a) 8 W/m^2
(b) 4 W/m^2
(c) 62.5 m W/m^2
(d) 1 m W/m^2

8. The value of a resistance as measured by a Wheatstone bridge is 10.0 K using a voltage source of 10.0 V. The same resistance is measured by the same bridge using 15.0 V. The value of resistance is
(a) 15.0 K
(b) 15.5 K
(c) 16.6 K
(d) 10.0 K

9. In the case of ABCD parameters, if all the impedances in the network are doubled, then
(a) A and D remain unchanged, C is halved and B is doubled
(b) A, B, C and D are doubled
(c) A and B are doubled, C and D are unchanged
(d) A and D are unchanged, C is doubled and B is halved

10. Unit step response of the system described by the equation y(n) + y(n – 1) = x(n) is
(a) $\frac{Z^2}{(Z+1)(Z-1)}$
(b) $\frac{Z}{(Z+1)(Z-1)}$

(c) $\frac{Z+1}{Z-1}$ (d) $\frac{Z(Z-1)}{(Z+1)}$

11. The transfer functions for the state representation of continuous time LTI system:

$\dot{q}(t) = Aq(t) + bx(t)$

$Y(t) = cq(t) + dx(t)$

is given by

(a) $c\,(sI - A)^{-1}\,b + d$ (b) $b\,(sI - A)^{-1}\,b + d$

(c) $c\,(sI - A)^{-1}\,b + d$ (d) $d\,(sI - A)^{-1}\,b + c$

12. The diffusion length for holes L_P, is the

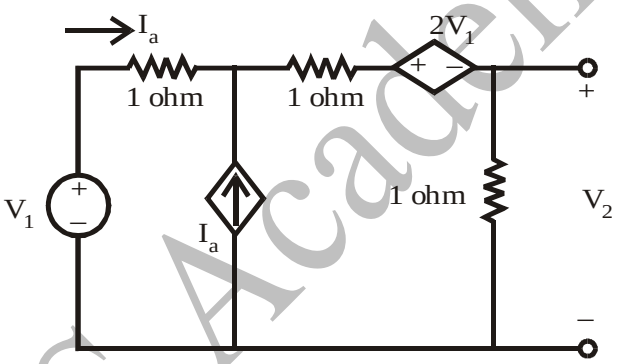
(a) Average distance which an injected hole travels before recombining with an electron

(b) Maximum distance traveled by a hole before recombining with an electron

(c) Length of the region in which diffusion takes place

(d) Minimum distance traveled by a hole before it recombines with an electron

13.



The above network contains resistors and controlled sources. $G_{12} = \frac{V_2}{V_1}$ is

(a) $-\frac{4}{5}$ (b) $-\frac{3}{5}$

(c) $-\frac{2}{5}$ (d) $-\frac{1}{5}$

14. The frequency response $H(\Omega)$ of a system for impulse sequence response $h[n] = \delta[n] + \delta[n-1]$ is

(a) $H(\Omega) = 2\cos\left(\frac{\Omega}{2}\right)\angle -\frac{\Omega}{2}$

(b) $H(\Omega) = \cos\Omega \angle -\Omega$

(c) $H(\Omega) = 2\cos\Omega \angle -\frac{\Omega}{2}$

(d) $H(\Omega) = 2\angle -\frac{\Omega}{2}$

15. Consider the following statements:
The inter element spacing of

1. More than λ in array antenna will produce grating lobes in unscanned condition.
2. More than $\frac{\lambda}{2}$ but less than λ in array antenna will produce grating lobe under scanned condition.
3. Less than $\frac{\lambda}{2}$ in array antenna will not produce any grating lobe.
4. More than 1.5 λ in array antenna will not produce any grating lobe.

Which of the above statements are correct?

(a) 1 and 2 only (b) 3 and 4 only
(c) 1, 2 and 3 only (d) 1, 2, 3 and 4

16. Match List I with List II and select the correct answer using the code given below the lists:

List I (Excitation)	List II (Two-port parameters)
A. I_1, I_2	1. z
B. V_1, V_2	2. y
C. V_1, I_2	3. g
D. I_1, V_2	4. h

Code:

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	3	1
(c)	1	3	2	4
(d)	4	3	2	1

17. Consider the following statements for a symmetrical T section:

1. Z_{11} and Z_{22} are equal.
2. Z_{12} and Z_{21} are equal.
3. Z_{11} and Z_{12} are equal.
4. Z_{21} and Z_{22} are equal.

Which of the above statements are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 3 and 4 only
(d) 1, 2, 3 and 4

18. The magnetic flux density B and the vector magnetic potential a are related as

(a) $B = \nabla \times A$
(b) $A = \nabla \times B$
(c) $B = \nabla . A$
(d) $A = \nabla . B$

19. Two milli ammeters with full scale currents of 1 mA and 10 mA are connected in parallel and they read 0.5 mA and 2.5 mA respectively. Their internal resistances are in the ratio of

(a) 1 : 10 (b) 10 : 1
(c) 1 : 5 (d) 5 : 1

20. The Fourier transform of unit step sequence is

(a) $\pi\delta(\Omega)$ (b) $\frac{1}{1-e^{-j\Omega}}$

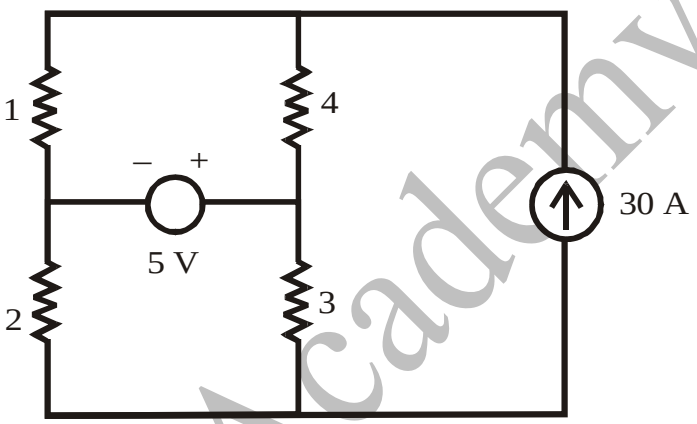
(c) $\pi\delta(\Omega)+\frac{1}{1-e^{-j\Omega}}$ (d) $1-e^{-j\Omega}$

21. A long 1 metre thick dielectric ($\varepsilon = 3\ \varepsilon_o$) slab occupying the region $0 < x < 5$ is placed perpendicularly in a uniform electric field $\bar{E}_o = 6\,\bar{a}_X$. The polarization $\bar{P}_i$ inside the dielectric is

(a) $4\ \varepsilon_o\ \bar{a}_X$ (b) $8\ \varepsilon_o\ \bar{a}_X$

(c) $36\ \varepsilon_o\ \bar{a}_X$ (d) Zero

22.



The power dissipated in the 1Ω resistor is 1 W due to the 5 V voltage source along and 576 W due to 30 A current source alone. The total power absorbed in the same resistor due to both the sources is

(a) 577 W (b) 575 W

(c) 625 W (d) 529 W

23. Consider the following statements regarding an FET:

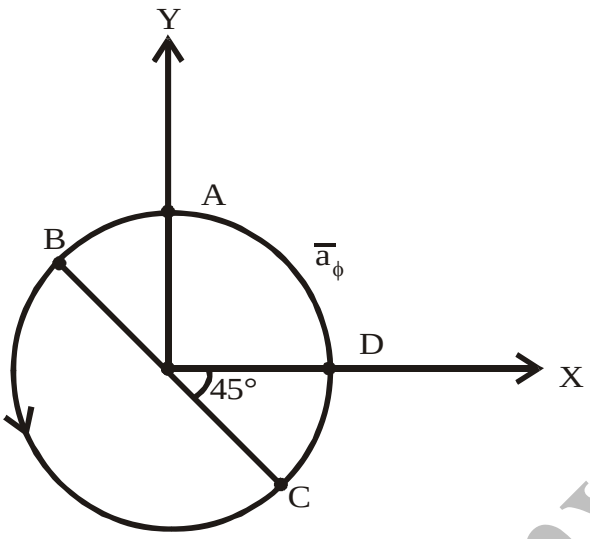
1. Its operation depends upon the flow of majority carriers only.
2. It has a high input resistance.
3. It is suitable for high frequency.
4. Its operation depends upon the flow of both majority and minority carriers.

Which of the above statements are correct?

(a) 1, 2, 3 and 4 (b) 1 and 2 only

(c) 2 and 3 only (d) 3 and 4 only

24.



Consider points A, B, C and D on a circle of radius 2 units as in the above figure. The items in List II are the values of $\bar{a}_\phi$ at different points on the circle. Match List I with List II and select the correct answer using the code given below the lists:

List I	List II
A.	1. $\bar{a}_X$
B.	2. $\bar{a}_Y$
C.	3. $-\bar{a}_X$
D.	4. $\frac{(\bar{a}_X + \bar{a}_Y)}{\sqrt{2}}$
	5. $\frac{-(\bar{a}_X + \bar{a}_Y)}{\sqrt{2}}$
	6. $\frac{(\bar{a}_X - \bar{a}_Y)}{\sqrt{2}}$

Code:

	A	B	C	D
(a)	3	4	5	2
(b)	1	6	5	2
(c)	1	6	2	4
(d)	3	5	4	2

25. The *incorrect* statement is
(a) Thermistor has a high sensitivity.
(b) Thermocouple does not require an external electrical source for its operation.
(c) Platinum has a linear R – T relationship.
(d) Thermistor does not require an external electrical source for its operation.

26. In ionic crystals, electrical conductivity is
(a) Very high
(b) Depends on material
(c) Depends on temperature
(d) Practically zero

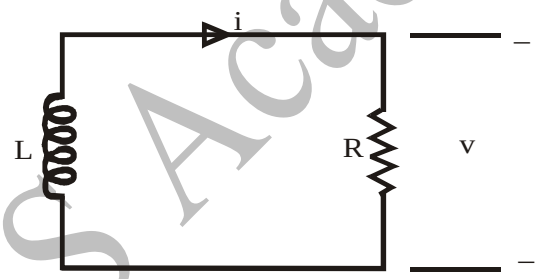
27. Consider the following statements:
1. The Laplace transform of the unit impulse function is s × Laplace transform of the unit ramp function.
2. The impulse function is a time derivative of the ramp function.
3. The Laplace transform of the unit impulse function is s × Laplace transform of the unit step function.
4. The impulse function is a time derivative of the unit step function.

Which of the above statements are correct?
(a) 1 and 2 only (b) 3 and 4 only
(c) 2 and 3 only (d) 1, 2, 3 and 4

28. The flux and potential functions due to a line charge and due to two concentric circular conductors are of the following form:
(a) Concentric circular equipotential lines and straight radial flux lines
(b) Concentric circular flux lines and straight equipotential lines
(c) Equipotentials due to line charge are concentric cylinders and equipotentials due to two conductors are straight lines
(d) Equipotentials due to line charge are straight flat surfaces and those due to two conductors are concentric cylinders.

29. LED is a
(a) p-n diode (b) Thermistor
(c) Gate (d) Transistor

30.



Voltage and current expressions for the above circuit are given at $t \geq 0$ as $v = 125\, e^{-50t}$ V, $i = 5\, e^{-50t}$ A. The value of L will be
(a) 0.005 H (b) 0.05 H
(c) 0.5 H (d) 5 H

31. Consider the following statements:
Fourier series of any periodic function X(t) can be obtained if
1. $\int_0^1 |x(t)|\, dt < \infty$
2. Finite number of discontinuous exists within finite time interval t.

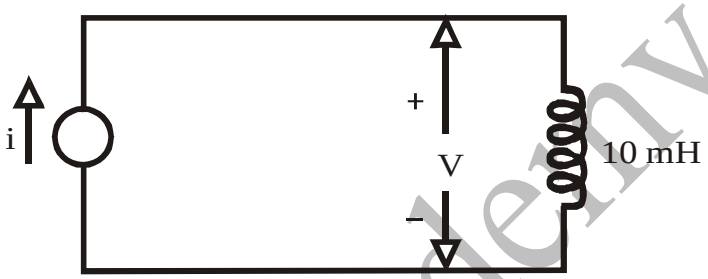
Which of the above statements is/are correct?
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

32. In a variable type carbon resistor the carbon track is formed of a mixture of carbon, resin and
(a) Clay (b) Manganese
(c) Nickel (d) Cadmium

33. A standard air filled waveguide WR-187 has inside wall dimensions of a = 4.755 cm and b = 2.215 cm. At 12 GHz, it will support
(a) TE_{10} mode only
(b) TE_{10} and TE_{20} modes only
(c) TE_{10}, TE_{20} and TE_{01} modes only
(d) TE_{10}, TE_{20}, TE_{01} and TE_{11} modes

34. A single strain gauge of resistance 120 Ω is mounted along the axial direction of an axially loaded specimen of steel (E = 200 GPa). The percentage change in length of the rod due to loading is 3% and the corresponding change in resistivity of strain gauge material is 0.3%. For a Poisson's ratio of 0.3, the value of the gauge factor is
(a) 1.3 (b) 1.5
(c) 1.7 (d) 2.0

35.

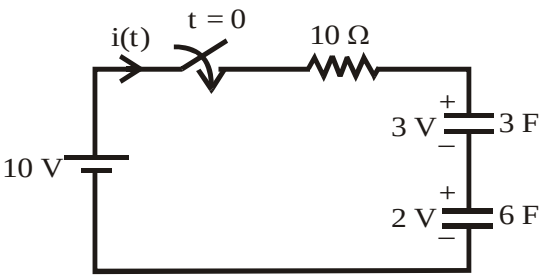


In the above shown circuit, the independent current source generates zero current for t < 0 and a pulse 5 t e^{-4t} A, for t > 0. At what instant of time, will the current attain the maximum value in the circuit?
(a) 0.25 sec (b) 0.5 sec
(c) 1 sec (d) 2 sec

36. Frequency scaling [relationship between discrete time frequency (Ω) and continuous time frequency (ω)] is defined as
(a) $\omega = 2\,\Omega$ (b) $\omega = 2\,\frac{T_S}{\Omega}$
(c) $\Omega = 2\,\frac{\omega}{T_S}$ (d) $\Omega = \omega\, T_S$

37. The intrinsic impedance of copper at 3 GHz (with parameters:
$\mu = 4\pi \times 10^{-7}$ H/m; $\varepsilon = 10^{-79}/36\pi$; and
$\sigma = 5.8 \times 10^{7}$ mho/m)
Will be
(a) 0.02 $e^{j\pi/4}$ ohm (b) 0.02 $e^{j\pi/2}$ ohm
(c) 0.2 $e^{j\pi/2}$ ohm (d) 0.2 $e^{j\pi/4}$ ohm

38.



In the circuit shown above, switch S is closed at t = 0. The time constant of the circuit and initial value of current i(t) are

(a) 30 sec, 0.5 A (b) 60 sec, 1.0 A
(c) 90 sec, 1.0 A (d) 20 sec, 0.5 A

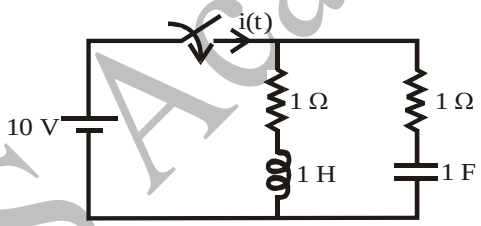
39. A voltage source of 240 volts having an internal impedance of (3 – j4) Ω is supplying power to a complex load impedance Z_1. What will be the maximum power transferred to the load?

(a) 2.4 kW (b) 3.6 kW
(c) 4.8 kW (d) 6.0 kW

40. Atomic number of silicon is

(a) 12 (b) 13
(c) 14 (d) 15

41.



The value of the current i(t) in amperes in the above circuit is

(a) 0 (b) 10
(c) $10\ e^{-t}$ (d) $10\ (1 - e^{t})$

42. A short current element has length l = 0.03 λ, where λ is the wavelength. The radiation resistance for uniform current distribution is

(a) $0.072\ \pi^2\ \Omega$ (b) $80\ \pi^2\ \Omega$
(c) 72 Ω (d) 80 Ω

43. If random process X(t) and Y(t) are orthogonal then

(a) $S_{XY}(f) = 0$ (b) $S_{XY}(f) = S_X(\ ) = S_Y(\ )$
(c) $R_{XY}(\tau) = h(\tau)$ (d) $H(f) = 0$

44. A first order circuit is excited with a dc source. The current i(t) through any element of the circuit can be written as (i_f and i_i are the final and initial values, respectively, of the current)

(a) $i_i - (i_i - i_f)\ e^{-\frac{t}{T}}$ (b) $i_f - (i_f - i_i)\ e^{-\frac{t}{T}}$

(c) $i_i - (i_f - i_i)\, e^{-\frac{t}{T}}$ (d) $i_f - (i_i - i_f)\, e^{-\frac{t}{T}}$

45. Match List I with List II and select the correct answer using the code given below the lists:

List I

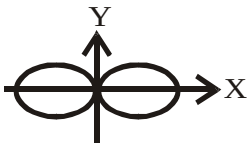
A. $\frac{d}{\lambda} = 0.25, \alpha = 90°$

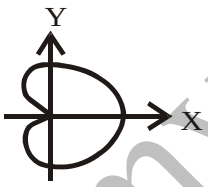
B. $\frac{d}{\lambda} = 0.5, \alpha = 0°$

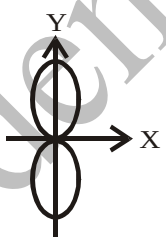
C. $\frac{d}{\lambda} = 0.5, \alpha = 180°$

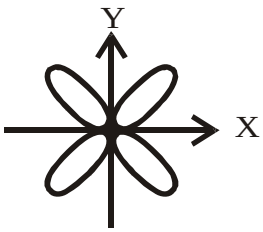
D. $\frac{d}{\lambda} = 1.0, \alpha = 180°$

List II

1. 

2. 

3. 

4. 

Code:

	A	B	C	D
(a)	4	3	1	2
(b)	2	1	3	4
(c)	4	1	3	2
(d)	2	3	1	4

46. The output of a linear system for step input is, $t^2 e^{-2t}$. Then the transfer function is

(a) $\frac{s}{(s+1)^2}$ (b) $\frac{2s}{(s+1)^3}$

(c) $\frac{s}{s^2(s+1)}$ (d) $\frac{1}{(s+1)^3}$

47. In a three element Yagi antenna

(a) All the three elements are of equal length

(b) The driven element and the director are of equal length but the reflector is longer than both of them
(c) The reflector is longer than the driven element which in turn is longer than the director
(d) The reflector is longer than the driven element which in turn is longer than the reflector

48. Consider the following statements regarding depth of penetration or skin depth in a conductor:
1. It increases as frequency increases.
2. It is inversely proportional to square root of μ and σ.
3. It is inversely proportional to square root of f.
4. It is directly proportional to square root of μ and σ.

Which of the above statements are correct?
(a) 1 and 2 only (b) 3 and 4 only
(c) 2 and 3 only (d) 1, 2, 3 and 4

49. Consider the following statements regarding the use of Laplace transforms and Fourier transforms in circuit analysis:
1. Both make the solution of circuit problems simple and easy.
2. Both are applicable for the study of circuit behavior for $t - \alpha$ to α.
3. Both convert differential equations to algebraic equations.
4. Both can be used for transient and steady state analysis.

Which of the above statements are correct?
(a) 1, 2, 3 and 4 (b) 2, 3 and 4 only
(c) 1, 2 and 4 only (d) 1, 3 and 4 only

50. The mode with lowest cutoff frequency for an electromagnetic wave propagating between two perfectly conducting parallel plates of infinite extent is
(a) TE_{10} (b) TM_{10}
(c) TM_{01} (d) TEM

51. Encoder
(a) Assigns quantized values
(b) Changes quantized values to binary values
(c) Changes quantized values to numerical values
(d) Changes numerical values to binary values

52. Consider the following statements:
1. (Electric or magnetic) field must have two orthogonal linear components.
2. The two components must have the same magnitude.
3. The two components must have a time-phase difference of odd multiples of 90°.

Which of these are the necessary and sufficient conditions for a time-harmonic wave to be circularly polarized at a given point in space?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1, 2 and 3 (d) 1 and 3 only

53. If the response of LTI continuous time system to unit step input is $\left(\frac{1}{2} - \frac{1}{2}e^{-2t}\right)$, then impulse response of the system is

(a) $\left(\frac{1}{2}-\frac{1}{2}e^{-2t}\right)$ (b) (e^{-2t})
(c) $(1-e^{-2t})$ (d) Constant

54. Consider the following statements regarding Thermistor:
1. It has a high sensitivity.
2. It has a linear relationship with temperature.
3. It is a resistive device.
4. It can be used as a time-delay device.

Which of the above statements are correct?
(a) 1, 2, 3 and 4 (b) 2, 3 and 4 only
(c) 1, 3 and 4 only (d) 1, 2 and 3 only

55. In cylindrical waveguides the attenuation will be minimum, at a frequency which is $\sqrt{3}$ times the cutoff frequency for the following modes of operations:
1. TE_{10} 2. TM_{11}
3. TM_{10} 4. TE_{11}

Which of the above are correct?
(a) 1, 2, 3 and 4 (b) 2 and 3 only
(c) 1 and 2 only (d) 3 and 4 only

56. In a junction transistor, recombination of electrons and holes occurs in
(a) Base region only
(b) Emitter region only
(c) Collector region only
(d) All the 3 regions

57. Given a range of frequencies, which of the following systems is best of transmission line load matching?
(a) Single stub
(b) Double stub
(c) Single stub with adjustable position
(d) Quarter wave transformer

58. An axial magnetic field is applied to a cylindrical rod. The Faraday rotation of a plane polarized beam after emergence from the rod is 5°. If both the field and length of the rod are doubled, then the angle of rotation is
(a) 40° (b) 5°
(c) 10° (d) 20°

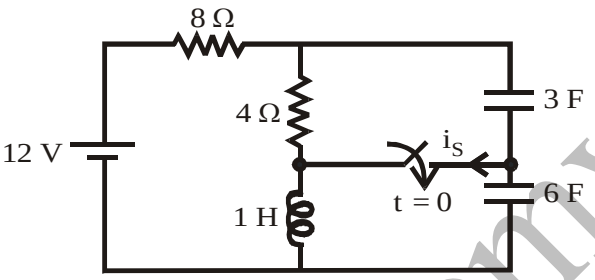
59. Consider the following statements relating to the cavity resonator:
1. The cavity resonator does not possess as many modes as the corresponding waveguide does.
2. The resonant frequencies of cavities are very closely spaced.
3. The resonant frequency of a cavity resonator can be changed by altering its dimensions.

Which of the above statements is/are correct?
(a) 2 and 3 only (b) 2 only
(c) 3 only (d) 1, 2 and 3

60. **Consider the following statements:**
For a rectangular waveguide with dimensions a × b where b is the narrow dimension, small value of b
1. Gives a larger separation between cutoff frequencies of TE_{01} and TE_{10} modes.
2. Gives increased attenuation.
3. Limits power handling capabilities because of breakdown field limits.

Which of the above statements is/are correct?
(a) 1 and 2 only (b) 1, 2 and 3
(c) 2 only (d) 3 only

61.



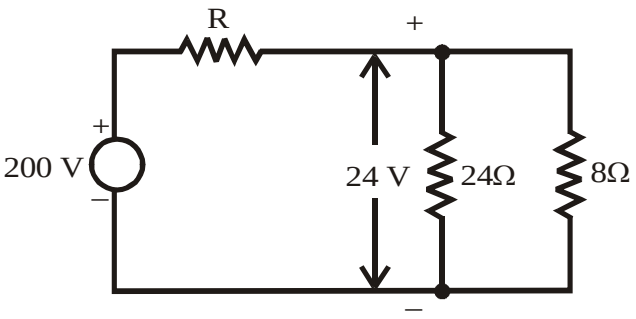
In the circuit shown above, the switch is closed after a long time. The current is(0^+) through the switch is

(a) 1 A (b) $\frac{2}{3}$ A
(c) $\frac{1}{3}$ A (d) 0 A

62. **If a random process X(t) is ergodic then, statistical averages**
(a) And time averages are different
(b) And time averages are same
(c) Are greater than time averages
(d) Are smaller than time averages

63. **The correct statement is**
(a) Microtrip lines can support pure TEM mode of propagation but shielded coaxial lines cannot
(b) Microtrip lines cannot support pure TEM mode of propagation but shielded coaxial lines can
(c) Both microtrip lines and shielded coaxial lines can support pure TEM mode of propagation
(d) Neither microtrip lines nor shielded coaxial lines can support pure TEM mode of propagation

64.

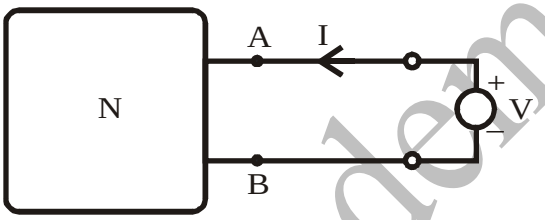


The value of R in the above circuit is

(a) 4 W (b) 40 Ω

(c) 44 W (d) 440 Ω

65.



For the network shown above

I = (0.2 V – 2) A, (I = the current delivered by the voltage source V). The venin voltage V_{th} and resistance R_{th} for the network N across the terminals AB are respectively

(a) – 10 V, 5 Ω (b) 10 V, 5Ω

(c) – 10 V, 0.2 Ω (d) 10 V, 0.2 Ω

66. Z and Laplace transform are related by

(a) $s = \ln z$ (b) $s = \frac{\ln z}{T}$

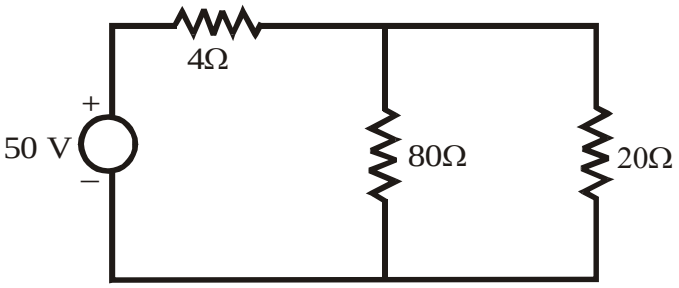
(c) $s = z$ (d) $s = \frac{T}{\ln z}$

67. A line of characteristic impedance 50 ohms is terminated at one end by +j50 ohms. The VSWR on the line is

(a) 1 (b) ∞

(c) 0 (d) j

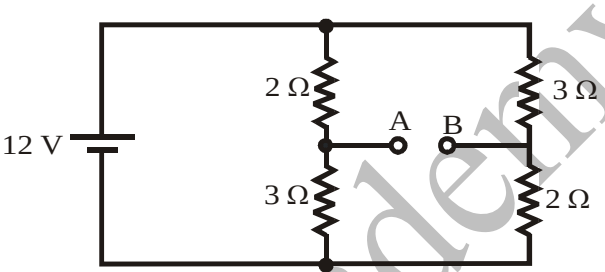
68.



The value of current in 80 Ω resistor of above circuit is

(a) 0.5 A (b) 2.0 A
(c) 5.0 A (d) 20.0 A

69.



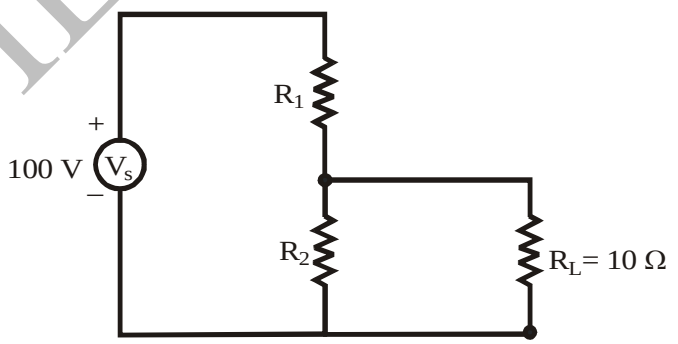
The venin equivalent voltage V_{AB} and resistance R_t across the terminals AB in the above circuit are

(a) 6 V, 5 Ω (b) 4 V, 5 Ω
(c) 2 V, 2.4 Ω (d) 2 V, 2.5 Ω

70. Alumina is a

(a) Dielectric (b) Ceramic
(c) Semiconductor (d) Conductor

71.



What is the voltage across the load resistance, R_L in the above circuit? The value of each resistor connected in the circuit is 10 Ω.

(a) 3.33 V (b) 33.33 V
(c) 333.33 V (d) 0 V

72. At UHF short-circuited lossless transmission lines can be used to provide appropriate values of impedance. Match List I with List II and select the correct answer using the code given below the lists:

List I	List II
A. $l < \frac{\lambda}{4}$	1. Capacitive
B. $l = \frac{\lambda}{4} < l < \frac{\lambda}{2}$	2. Inductive
C. $l = \frac{\lambda}{4}$	3. 0
D. $l = \frac{\lambda}{2}$	4. ∞

Code:

	A	B	C	D
(a)	2	1	4	3
(b)	3	1	4	2
(c)	2	4	1	3
(d)	3	4	1	2

73. Convolution of two sequences $X_1[n]$ and $X_2[n]$ is represented as

(a) $X_1(z) * X_2(z)$ (b) $X_1(z)\, X_2(z)$

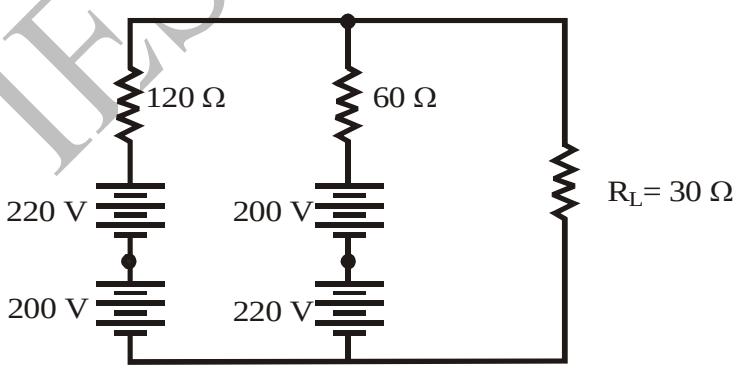
(c) $X_1(z) + X_2(z)$ (d) $\frac{X_1(z)}{X_2(z)}$

74. A half-wave dipole working at 100 MHz in free space radiates a power of 1000 Watts. The field strength at a distance of 10 kms in the direction of maximum radiation is

(a) 1.73 mV/m (b) 2.12 mV/m

(c) 2.22 mV/m (d) 22.2 mV/m

75.



In the circuit shown above, the current through R_L is

(a) 6 A (b) 4 A

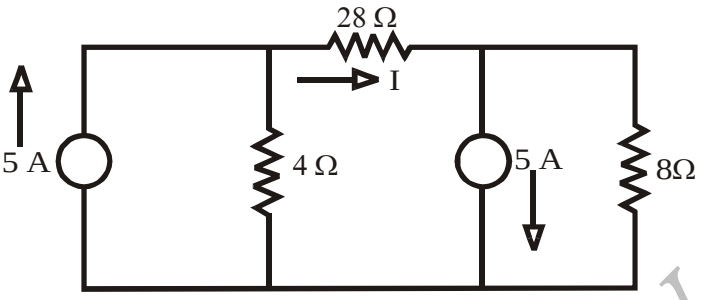
(c) 2 A (d) 0

76. Decimation is the process of

(a) Retaining sequence values of $X_P[n]$ other than zeroes

(b) Retaining all sequence values of $X_P[n]$
(c) Dividing the sequence value by 10
(d) Multiplying the sequence value by 10

77.



In the circuit shown above, the current I is
(a) 1 A
(b) 1.5 A
(c) 2.5 A
(d) 4 A

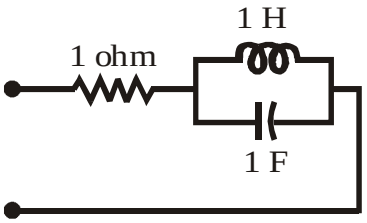
78. It is required to find the current through a particular branch of a linear bilateral network without mutual coupling when the branch impedance takes four different values. Which one of the following methods will be preferred?
(a) Mesh analysis
(b) The venin's equivalent circuit
(c) Nodal analysis
(d) Superposition theorem

79. A source having internal impedance of (9 + j12) Ω is to deliver maximum power to a resistive load. The load resistance should be
(a) 9 Ω
(b) 12 Ω
(c) 15 Ω
(d) 21 Ω

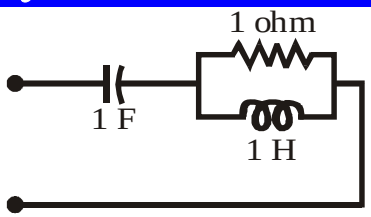
80. There are two conducting plates of sizes 1 m × 1 m and 2 m × 2 m. Ratio of the capacitance of the second one with respect to that of the first one is
(a) 4
(b) 2
(c) $\frac{1}{2}$
(d) $\frac{1}{4}$

81. The driving point impedance of a network is given by $Z(s) = \frac{2s+1}{s(s+1)}$. The Foster realization of the network is

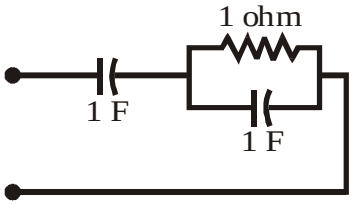
(a)



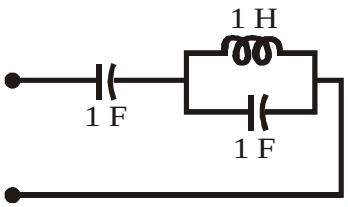
(b)



(c)



(d)



82. An air-filled rectangular waveguide has dimensions of a = 6 cm and b = 4 cm. The signal frequency is 3 GHz. Match List I with List II and selects the correct answer using the code given below the lists:

List I	List II
A. TE_{10}	1. 2.5 GHz
B. TE_{01}	2. 3.75 GHz
C. TE_{11}	3. 4.506 GHz
D. TM_{11}	4. 4.506 GHz

Code:

	A	B	C	D
(a)	1	2	3	4
(b)	4	2	3	1
(c)	1	3	2	4
(d)	4	3	2	1

83. If $X(\omega) = \delta(\omega - \omega_o)$ then X(t) is

(a) $e^{-j\omega_o t}$ (b) $\delta(t)$

(c) $\frac{1}{2\pi} e^{j\omega_o t}$ (d) 1

84. An electric charge of Q coulombs is located at the origin. Consider electric potential V and electric field intensity E at any point (x, y, z). Then

(a) E and V are both scalars
(b) E and V are both vectors
(c) E is a scalar and V is a vector
(d) E is a vector and V is a scalar

85. Consider the following statements regarding a transmission line:

1. Its attenuation is constant and is independent of frequency.
2. Its attenuation varies linearly with frequency.

3. Its phase shift varies linearly with frequency.
4. Its phase shift is constant and is independent of frequency.

Which of the above statements are correct for distortion less line?

(a) 1, 2, 3 and 4 (b) 2 and 3 only
(c) 1 and 3 only (d) 3 and 4 only

86. Match List I with List II and select the correct answer using the code given below the lists:

List I (Transducers)	List II (Type of transducer)
A. L.V.D.T.	1. Resistive
B. Strain Gauge	2. Inductive
C. Dielectric Gauge	3. Capacitive
D. Thermocouple	4. Self generating

Code:

	A	B	C	D
(a)	2	3	1	4
(b)	4	3	1	2
(c)	2	1	3	4
(d)	4	1	3	2

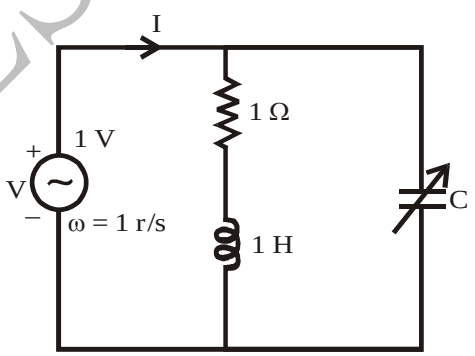
87. Consider the following:
In a parallel plate capacitor, let the charge be held constant while the dielectric material is replaced by a different dielectric. Consider

1. Stored energy.
2. Electric field intensity
3. Capacitance

Which of these changes?

(a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2 and 3

88.



In the above circuit, the value of C for the circuit to exhibit a power factor of 0.86 is approximately

(a) 0.4 F (b) 0.6 F
(c) 1.4 F (d) 0.1 F

89. A long straight non-magnetic conductor of radius 8 mm is carrying a uniform current density of 100 kA/m² in the az direction. For this case, which one of the following is *not* correct?

(a) $\nabla \times H = 10^5 a_Z$ A/m^2 for $0 < \rho < 8$ mm
(b) $\nabla \times B = 0$
(c) The magnetic field intensity for $\rho > 8$ mm is $\frac{10^5}{2} \rho a_\phi$ A/ m
(d) The total current carried by the conductor is 6.4π A

90. Consider the following statements:
They are given as necessary conditions for driving point functions with common factors in p(s) and q(s) cancelled:
1. The coefficients of the polynomial in p(s) and q(s) must be real.
2. Poles and zeroes must be conjugate pairs if imaginary or complex.
3. The terms of lowest degree in p(s) and q(s) may differ in degree by one at most.

Which of the above statements is/are correct?
(a) 1, 2 and 3 (b) 1 only
(c) 1 and 2 only (d) 2 and 3 only

91. For distortion less transmission through LTI system phase of H(ω) is
(a) Constant (b) One
(c) Zero (d) Linearly dependent on ω

92. Consider the following statements:
1. The coefficients in the polynomials p(s) and q(s) must be real and positive.
2. Poles and zeroes of z(s) must be conjugate if imaginary or complex.

Which of these statements are associated with the driving point function $Z(s) = \frac{p(s)}{q(s)}$?
(a) Both 1 and 2 (b) 1 only
(c) 2 only (d) Neither 1 nor 2

93. Consider the following statements relating to the electrostatic and magneto static fields:
1. The relative distribution of charges on an isolated conducting body is dependent on the total charge of the body.
2. The magnetic flux through any closed surface is zero.

Which of the above statements is/are correct?
(a) Neither 1 nor 2 (b) 1 only
(c) 2 only (d) Both 1 and 2

94. The crystal in which atoms are chemically highly inactive and they do not form compounds with other atoms is
(a) Ionic crystal (b) Metal
(c) Valence crystal (d) Vander Waals crystal

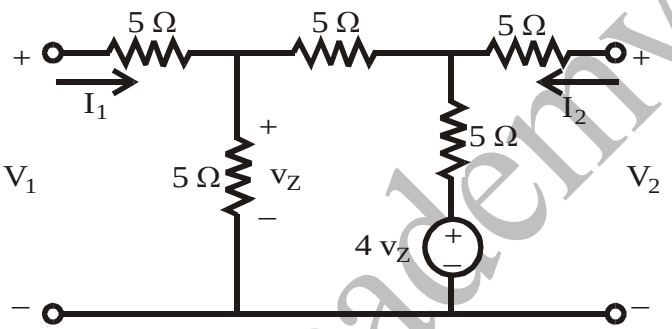
95. A two-port network has the ABCD parameters $\begin{bmatrix} 7 & 8 \\ 3 & 4 \end{bmatrix}$. Two such identical networks are cascaded. The ABCD parameters of the overall cascaded network will be
(a) $\begin{bmatrix} 14 & 16 \\ 6 & 8 \end{bmatrix}$ (b) $\begin{bmatrix} 73 & 88 \\ 33 & 40 \end{bmatrix}$

(c) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 49 & 64 \\ 9 & 16 \end{bmatrix}$

96. A circuit consists of two clocked JK flip-flops connected as follows: $J_0 = K_0 = \bar{Q}_1$, $J_1 = Q_0$ and $K_1 = \bar{Q}_0$. Each flip-flop receives the clock input simultaneously. The circuit acts as a
(a) Counter of mod 3 (b) Counter of mod 4
(c) Shift-left register (d) Shift-right register

97. Which one of the following is *not* a ferromagnetic material?
(a) Cobalt (b) Iron
(c) Nickel (d) Bismuth

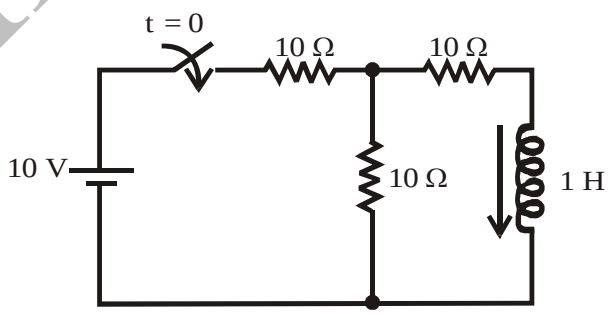
98.



With reference to the above network the value of Z_{11} will be
(a) – 3 (b) 3
(c) – 1 (d) – 5

99. When donor atoms are added to semiconductor, it
(a) Increases the energy band gap of the semiconductor
(b) Decreases the energy band gap of the semiconductor
(c) Introduces a new narrow band gap near the conductor band
(d) Introduces a new discrete energy level below the conduction band

100.



The value of V that would result in a steady-state current of 1 A through the inductor in the above circuit is
(a) 30 V (b) 15 V
(c) 20 V (d) 25 V

Directions: Each of the next twenty (20) items consists of two statements, one labeled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the code given below:

Codes:

(a) Both A and R are individually true and R is the correct explanation of A
(b) Both A and R are individually true but R is *not* the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

101. **Assertion (A):** A linear system gives a bounded output if the input is bounded.

Reason (R): The roots of the characteristic equation have all negative real parts and the response due to initial conditions decay to zero as time t tends to infinity.

102. **Assertion (A):** The system described by $y^2(t) + 2y(t) = x^2(t) + x(t) + c$ is a linear and static system.
Reason (R): The dynamic system is characterized by differential equation.

103. **Assertion (A):** When five percent of silver is added to copper to form an alloy, the electrical resistivity of the alloy is more than that of pure copper.
Reason (R): Silver has a higher value of resistivity than that of copper.

104. **Assertion (A):** Magnetic susceptibility value of an ant ferromagnetic substance at 0^o K is zero.
Reason (R): At 0^o K, atomic magnetic moments are frozen with magnetic dipoles pointing in random directions.

105. **Assertion (A):** A thermocouple is an active component.
Reason (R): It is activated by a temperature gradient.

106. **Assertion (A):** Synthesis problem is not unique in the sense that we may be able to find more than one network which provides prescribed response.
Reason (R): The problem of synthesis deals with the design and specification of the network

107. **Assertion (A):** In an intrinsic semiconductor, electron mobility in conduction band is different from whole mobility in valence band.
Reason (R): In an intrinsic semiconductor, electrons and holes are created solely by thermal excitation across the energy gap.

108. **Assertion (A):** At very high temperatures, both p and n-type semiconductors behave as intrinsic semiconductor.
Reason (R): In n-type semiconductor the majority carriers are electrons and in a p-type semiconductor the majority carriers are holes, whereas in an intrinsic semiconductor the number of holes and electrons are equal.

109. **Assertion (A):** In an intrinsic semiconductor, the concentration of electrons and holes increases with increase in the temperature.
Reason (R): Law of mass action holds good in case of semiconductors.

110. **Assertion (A):** Capacitance between two parallel plates of area 'A' each and distance of separation 'd' is $\frac{\varepsilon A}{d}$ for large $\frac{A}{d}$ ratio.

Reason (R): Fringing electric field can be neglected for large $\frac{A}{d}$ ratio.

111. **Assertion (A):** In solving boundary value problems, the method of images is used.

Reason (R): By this technique, conducting surfaces can be removed from the solution domain.

112. **Assertion (A):** The velocity of light in any medium is slower than that of vacuum.

Reason (R): The dielectric constant of the vacuum is unity and is lesser than that of any other medium.

113. **Assertion (A):** To obtain high Q, a resonator should have a large ratio of volume to surface area.
Reason (R): It is the volume that stores energy and it is the surface area that dissipates energy.

114. **Assertion (A):** TEM (Transfer Electro Magnetic) waves cannot propagate within a hollow waveguide of any shape.
Reason (R): For a TEM wave to exist within the waveguide, lines of H field must be closed loops which require an axial component of E which is not present in a TEM wave.

115. **Assertion (A):** Si is mainly used for making ICs and not Ge.
Reason (R): In Si, SiO_2 layer which acts as an insulator can be formed for isolation purposes. Corresponding oxide layer cannot be formed in Ge.

116. **Assertion (A):** The short-circuit current gain of a bipolar junction transistor, in common base configuration increases with increase in the reverse bias collector to base voltage.
Reason (R): With increase in the reverse bias collector to base voltage, the effective base width decreases.

117. **Assertion (A):** A bipolar junction transistor is basically a current amplifier.
Reason (R): The most simplified model of a BJT has a current dependent current source in its output circuit, whose magnitude directly depends upon the input current.

118. **Assertion (A):** If we have two p-n-p and n-p-n transistors of identical construction, the n-p-n transistor will have better frequency response characteristic compared to the p-n-p transistor.
Reason (R): The diffusion constant of electron is higher than that of holes.

119. **Assertion (A):** Many semiconductors where minimum energy in the conduction band and maximum energy in the valence band occur at the same value of $\vec{k}$ (wave vector), are preferred for optical lenses.
Reason (R): For such semiconductors, the efficiency of carrier generation and recombination is very high.

120. **Assertion (A):** At low temperature, the conductivity of a semiconductor increases with increase in the temperature.
Reason (R): The breaking of the covalent bonds increases with increase in the temperature, generating increasing number of electrons and holes.