ELECTRONICS AND TELECOMMUNICATION ENGINEERING

PAPER-I

1. Let h(t) be the response of a linear system to unit impulse δ(t). Consider the following statements in this regard:
   1. If the system is causal, h (t) = 0 for t <0.
   2. If the system is time variable, then the response or the system to an input of δ (t - T) is h (t - T) for all values of the constant T.
   3. If the system is non - dynamic, then h (t) is of the form A δ (t), where the constant A depends on the system.

   Of these statements
   a. 1 and 2 are correct
   b. 1 and 3 are correct
   c. 2 and 3 are correct
   d. 1, 2 and 3 are correct

2. Which one of the following systems is non linear[y (t) output ; x (t) = input]
   a. $y(t)=2x(t-1)-3x(t-2)+x(t-3)$
   b. $y(t)=5x(t)$
   c. $y(t)=2x(t-1)-x(t-2)-x(t-4)$
   d. $y(t)=2x(t)+3.6$

3. Which one of the following difference equations is non-recursive? [Y (k) = output ; u (k) = input]
   a. $y(k+2)+2y(k+1)-3y(k)=u(k+I)$
   b. $y(k+1)+y(k)=u(k+1)+2u(k)+u(k-1)$
   c. $y(k+1)+y(k)=u(k+1)+u(k)+u(k-I)$
   d. $y(k+1)+y(k)=u(k+1)+3u(k)+u(k-I)$

4. Of the following transfer functions of second order linear time invariant systems, the under damped system is represented by
   a. $H(s)=\dfrac{1}{s^2+4s+4}$
   b. $H(s)=\dfrac{1}{s^2+5s+4}$
   c. $H(s)=\dfrac{1}{s^2+4.5s+4}$
   d. $H(s)=\dfrac{1}{s^2+5s+4}$

5. A periodic voltage having the Fourier series v (t) = 1 + 4 sin ωt + 2 cos ωt volts is applied across a one - ohm resistor. The power dissipated in the one – ohm resistor is
   a. 1W
   b. 11W
   c. 21W
   d. 24.5W

6. Let F (ω) be the Fourier transform of a function f(t) ; then F(0) is
   a. $\int_{-\infty}^{\infty} f(t)dt$
   b. $\int_{-\infty}^{\infty} |f(t)|^2 dt$
   c. $\int_{-\infty}^{\infty} |tf(t)|^2 dt$
   d. $\int_{-\infty}^{\infty} tf(t)dt$

7. Given that the Fourier transform of f (t) is $f(j\omega)$, which of the following pairs of functions of time and the corresponding Fourier transforms are correctly matched?
   1. $f(t+2)$ .... $e^{j2\omega}F(j\omega)$
   2. $f(-0.5t)$ .... $2F(-2j\omega)$
   3. $\int_{-\infty}^{t} f(t)dt$ .... $F(j\omega)\left[\dfrac{1}{j\omega}+\pi\delta(\omega)\right]$

   Select the correct answer using the codes given below:

   Codes:
   a. 1 and 2

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b. 1 and 3

c. 2 and 3

d. 1,2 and 3

8. The impulse response of a single - pole system would approach a non-zero constant as $t \to \infty$ if and only if the pole is located in the s-plane

a. On the negative real axis

b. At the origin

c. On the positive real axis

d. On the imaginary axis

9. If x (t) and $\frac{dx(t)}{dt}$ are Laplace transformable and $\lim_{t \to \infty}$ x(t) exists, then $\lim_{t \to \infty}$ x(t) is equal to

a. $\lim_{s \to \infty} sX(S)$

b. $\lim_{s \to 0} sX(S)$

c. $\lim_{s \to \infty} \frac{X(S)}{s}$

d. $\lim_{s \to 0} \frac{X(S)}{s}$

10. If f_1 (t) and f_2 (t) are duration - limited signals such that

$f_1(t) \neq 0$ for $1 < t < 3 = 0$ elsewhere

f_2 (t) = 0 for $5 < t < 7 = 0$ elsewhere

Then the convolution of f_1 (t) and f_2 (t) is zero everywhere except for

a. $1 < t < 7$

b. $3 < t < 5$

c. $5 < t < 21$

d. $6 < t < 10$

11. The impulse response of a causal, linear time - invariant, continuous - time system is h (t). The output y (t) of the same system to an input x (t), where (t) = 0 for t < -2, is

a. $\int_0^t h(\tau) \cdot (t-\tau) d\tau$

b. $\int_{-2}^t h(\tau) \cdot (t-\tau) d\tau$

c. $\int_{-2}^{t-2} h(\tau) \times (t-\tau) d\tau$

d. $\int_0^{t+2} h(\tau) \times (t-\tau) d\tau$

12. If a (n) is the response of a linear, time invariant, discrete -time system to a unit step input, then the response of the same system to a unit impulse input is

a. $\frac{d}{dn}[a(n)]$

b. $n\,a(n)$

c. $a(n) - a(n-1)$

d. $a(n+1) - 2a(n) + a(n-1)$

13. If the function $H_1(z) = (1 + 1.5z^{-1} - z^{-2})$ and $H_2(z) = (z^2 + 1.5z - 1)$ then

a. The poles and zeros of the functions will be the same.

b. The poles of the functions will be identical but not zeros.

c. The zeros of the functions will be identical but not the poles.

d. Neither the poles, Nor the zeros of the two functions will be identical

14. The spectral density of a random signal is given by $\pi[\delta(w - w_0) + \delta(w + w_0)]$

The auto - correlation function of the signal is

a. $\cos w_0\tau$

b. $\sin w_0\tau$

c. $\cos[(w - w_0)\tau]$

d. $\sin[(w - w_0)\tau]$

15. The auto - correlation of a wide - sense stationary random process is given by $e^{-2|\tau|}$. The peak value of the spectral density is

a. 2

b. 1

c. $e^{-1/2}$

d. e

16. The covariance function, $C_x(\tau)$, of a stationary stochastic process, x(t), is said to be positive definite. This means that

a. $C_x(\tau) \geq 0$ for all τ

b. $\int_{-\infty}^{\infty} C_x(\tau) d\tau \geq 0$

c. $\int_{-\infty}^{\infty} C_x(\tau) \exp(-j\omega\tau) d\tau \geq 0$

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d. $C_x(0) \geq 0$

17. The depth of penetration or skin depth for an electromagnetic field of frequency 'f in a conductor of resistively ρ and permeability μ is

a. Inversely proportional to ρ and f and directly proportional to μ.

b. Directly proportional to ρ and in versely proportional to f and μ.

c. Directly proportional to f and inversely proportional to ρ and μ

d. Inversely proportional to ρ and μ and directly proportional to f

18. An isolated sphere in air has a radius equal to $1/4\pi\in_0$ meter, its capacitance will be

a. πF

b. 1F

c. 4π F

d. $\frac{1}{4\pi}F$

19. The displacement flux density at a point on the surface of a perfect conductor is $\bar{D}=2\left(\bar{a}-\sqrt{3}\hat{a}\right)$ C/m^2 and is pointing away from the surface. The surface charge density at the at point (C/m^2) will be

a. 2

b. -2

c. 4

d. -4

20. The torque (in N - m) acting on a circular current loop of radius 1 mm, in the xy - plane, connected at the origin and with current 0.1 A flowing in the sense of increasing ϕ in a magnetic field $B=10^{-5}\left(2\hat{a}_x-2\hat{a}_y+\hat{a}_z\right)$ Wb/m^2 is:

a. $-2\times10^{-12}\left(2\hat{a}_x-2\hat{a}_y+\hat{a}_z\right)$

b. $2\times10^{-11}\pi\left(\hat{a}_x+\hat{a}_y\right)$

c. $10^{-12}\pi$

d. $-10^{-12}\pi$

21. The given figure shows the surface charge distribution of q coulombs/m^2. What is the force on a unit charge placed the centre of circle?

a. Zero

b. $\frac{q}{4\pi R^2}N$

c. $\frac{q^2}{4\pi R^2}N$

d. $\frac{q^2}{4\pi R^2}N$

22. Consider an arbitrary distribution of conducting bodies in a charge - free space. According to the uniqueness theorem, which of following are required to be specified in order that the field is uniquely determined everywhere?

1. Total charge on each conductor.
2. Potential at each conductor surface.
3. Potential at some of the conductors and total charge on the remainder.
4. Total charge as well as potential gradient on each conductor surface.

Select the correct answer using the codes given below:

Codes:

a. 1 and 3

b. 2 and 4

c. 1,2 and 3

d. 1, 2,3and 4

23. A transmission line of characteristic impedance Z_0 = 50 ohms, phase velocity $v_p = 2\times10^8$ m/s, and length l = 1m is terminated by a load Z_L = (30-j40) ohms. The input impedance of the lime for a frequency of 100 MHz will be

a. (30 + j40) ohms

b. (30 – j40) ohms

c. (50 + j40) ohms

d. (50 – j40) ohms

24. A line of characteristic impedance z_0 ohms, phase velocity $v_p = 2\times10^8$ m/s and length l = 2m is terminated by a load impedance z_L ohms. The reflection coefficients at the input end and load end

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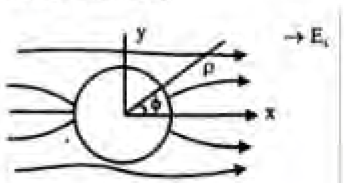
are respectively Γ_i and Γ_R. The ratio $\frac{\Gamma_i}{\Gamma_R}$ for a frequency of 50 MHz will be

a. 1
b. -1
c. $\sqrt{-1}$
d. 2

25. Consider a conducting cylinder along the z-axis in a uniform field $\vec{E} = \hat{x}E_x$ as shown in the given figure. The P- component of electric field strength in the region outside the cylinder is given by (a = radius of cylinder surface)



a. $E_\rho = \left(\frac{a^2}{\rho^2}+1\right)E_x \cos\phi$
b. $E_\rho = \left(\frac{a^2}{\rho^2}+1\right)E_x \sin\phi$
c. $E_\rho = \left(\rho^2+a^2\right)E_x \sin\phi$
d. $E_\rho = \left(\frac{\rho^2+a^2}{\rho^2 a^2}\right)E_x \sin\phi$

26. A point charge 'q' is situated at a distance 'd' from the centre of a grounded conducting sphere of radius 'R' (d > R). The value of the image charge is 'q' at a distance 'b' from the centre. The quantities 'q' and 'b' will be respectively

a. – (R/d) q and R^2/d
b. – (R^2/d) q and d^2/R
c. (R/d) q and R^2/d
d. – (R/d)q and d^2/R

27. The intensity of radiation of a dipole depends strongly on frequency. If, at a frequency f, the intensity of radiation is 'I', then at a frequency of f/2, the intensity will be

a. 1/2
b. 1/4
c. 1/8
d. 1/16

28. The ratio of the directivity of an end - fire antenna to that of a broad - side antenna is

a. 2
b. 3
c. 4
d. 5

29. In an isotropic inhomogeneous dielectric medium, free of charges and currents, 'the wave equation for electric field having harmonic time dependence of $\exp(j\omega t)$ is given by $\left(k^2 = \omega^2\mu\in\right)$:

a. $\nabla^2\vec{E} + \frac{\nabla\in}{\in} + k^2\vec{E} = 0$
b. $\nabla^2\vec{E} + \nabla\in\left(\in\vec{E}\right) + k^2\vec{E} = 0$
c. $\nabla^2\vec{E} + \nabla\left(\vec{E} + \frac{\nabla\in}{\in}\right) + k^2\vec{E} = 0$
d. $\nabla^2\vec{E} + \vec{E}\times\frac{\nabla\in}{\in} + k^2\vec{E} = 0$

30. A uniform plane wave is incident from free space (z < 0) normally on an isotropic perfect dielectric medium (z > 0), characterized by the permittivity matrix

$$[\in] = \in_0 \begin{bmatrix} 4 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 4 \end{bmatrix} \text{ and } \mu = \mu_0$$

The electric field of the incident wave is $E_i = E_0 \cos(\omega t - \beta z)\hat{a}_y$ where $\omega = 3\times10^9\pi$ and $\beta = 10\pi$. The electric field of the transmitted wave E_t is given by

a. $\frac{2}{3}E_0(\cos\omega t - \beta z)\hat{a}_x$
b. $\frac{2E_0}{3}\cos(\omega t - 2\beta z)\hat{a}_x$
c. $\frac{1}{2}E_0(\cos\omega t - \beta z)\hat{a}_x$
d. $\frac{1}{2}E_0\cos(\omega t - 3\beta z)\hat{a}_y$

31. For transmission of ware from a dielectric medium of permittivity $\in_1$ into a dielectric medium of lower permittivity $\in_2$ $(\in_1 > \in_2)$ the critical angle of incidence θ_c (relative to the interface is given by

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a. $\sin^{-1}\sqrt{\frac{\epsilon_2}{\epsilon_1}}$

b. $\cos^{-1}\sqrt{\frac{\epsilon_2}{\epsilon_1}}$

c. $\tan^{-1}\sqrt{\frac{\epsilon_2}{\epsilon_1}}$

d. $\sin^{-1}\left(\frac{\epsilon_2}{\epsilon_1}\right)$

32. For incidence from dielectric medium 1 (ϵ_1) on to dielectric medium $2(\epsilon_2)$, the Brewster angle θ_B and the corresponding angle of transmission θ_t for $\frac{\epsilon_2}{\epsilon_1} = 3$ will be respectively.
   a. 30° and 30°
   b. 30° and 60°
   c. 60° and 30°
   d. 60° and 60°

33. For the dominant mode, in a rectangular waveguide with breadth 10cm, the guide wavelength for a signal of 2.5 GHz will be
   a. 12 cm
   b. 15 cm
   c. 18 cm
   d. 20cm

34. The degenerate modes in a waveguide are characterized by
   a. Same cut-off frequencies but different field distributions
   b. Same cut-off frequencies and same field distributions
   c. Different cut-off frequencies but same field distributions
   d. Different cut-off frequencies and different field distributions

35. For TM waves in a parallel plate waveguide, the minimum attenuation arising from imperfect conductors would occur at a frequency of (f_c is the cut-off frequency)
   a. $3 f_c$
   b. $\sqrt{3 f_c}$
   c. $2 f_c$
   d. $\sqrt{2 f_c}$

36. For a rectangular waveguide (a × b, a > b) to support only the TE_{10} mode at wavelength λ. Which one of the following pairs of inequalities is to satisfied?
   a. $b < \lambda < 2b$; $\lambda > 2a$
   b. $b < \lambda < 2b$; $\lambda < 2a$
   c. $a < \lambda < 2a$; $\lambda > 2b$
   d. $a < \lambda < 2a$; $\lambda < 2b$

37. Which one of the following types of hollow cavity resonators of the same surface area would have the highest Q factor?
   a. Spherical cavity made of copper
   b. Spherical cavity made of silver
   c. Cylindrical cavity made of copper
   d. Cylindrical cavity made of silver

38. The sinusoidal time - varying vector field $\vec{F} = 2\cos(\omega t + 30^\circ)\hat{a}_x + 2\cos(\omega t - 30^\circ)\hat{a}_y$
   a. Elliptically polarized
   b. Circularly polarized
   c. Linearly polarized
   d. Unpolarized

39. For a uniform plane wave of frequency 10^9 Hz propagating in a good conductor, the field undergoes a change in phase by 2π radians over a distance of 1m. the field is attenuated by a factor of 1/e at a distance of
   a. $\frac{1}{2\pi} m$
   b. $\frac{1}{\pi} m$
   c. π m
   d. 2π m

40. The sum of two oppositely rotating circularly polarized, waves of equal amplitude will be
   a. A circularly polarized wave
   b. A linearly polarized wave
   c. An elliptically polarized wave
   d. An unpolarized wave

41. The ground wave gradually disappears as one moves away from the transmitter because of

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a. Loss of line of sight conditions
b. Interference from the sky waves
c. Maximum single hop distance limitation
d. Finite conductivity of the earth's surface

42. The sensitivity of a voltmeter using 0 to 5 mA meter movement is
a. 50 ohm/volt
b. 100 ohm/volt
c. 200 ohm/volt
d. 500 ohm/volt

43. Two sinusoidal signals having the same amplitude and frequency are applied to tile X and Y inputs of a CRO. The observed Lissajous figure is a straight line. The phase shift between the two signals would be
a. Zero
b. 90 degrees
c. Either zero or 180 degrees
d. Either 90 degrees or 270 degrees

44. If a dynamometer type wattmeter is connected in an ac circuit, the power indicated by the wattmeter will be
a. Volt - ampere product
b. Average power
c. Peak power
d. Instantaneous power

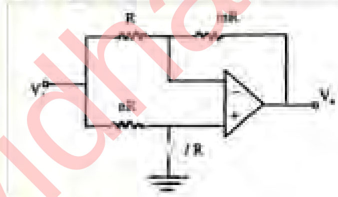
45. DC voltage of the order a few mV can be measured accurately using a/an
a. Moving coil voltmeter
b. Null-balancing potentiometer
c. Moving iron voltmeter
d. Electrostatic voltmeter

46. On a voltage scale, zero dBM in a 600-ohm system would refer to
a. 1.732 V
b. 1.0V
c. 0. 7746 V
d. 0.5. V

47. The "accuracy' of a measuring instrument is determined by the
a. Closeness of the value indicated by it to the correct value of the measured
b. Repeatability of the measured value
c. Speed with which the instrument's reading approaches the final value
d. Least change in the value of the measured that could be detected by the instrument

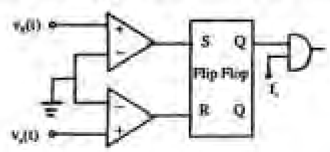
48. Two resistors R_1=36 ohm and R_2 =75 ohms, each having tolerance of ± 5% are connected in series. The value of the resultant resistance will be
a. 111±0 ohm
b. 111 ±2.778 ohm
c. 111±5.55ohm
d. 111 ±7.23

49. In the circuit shown, it is required that $V_0 = V_1$ the values of *l*, m, n are respectively. (x represents don't care condition)



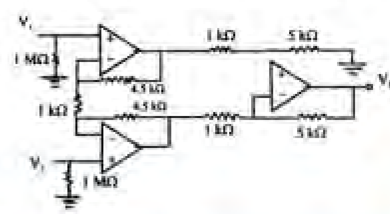
a. 0,1,1
b. ∞,x, x
c. x, ∞,x
d. 0,x, ∞

50. Part of a digital phase meter is shown in the figure, If the input signals are $v_R(t) = V_R \sin \omega t$ and $V_p(t) = V_p \sin(\omega t + 30°)$ the reading of the meter will be



a. 30°
b. 330°
c. 150°
d. 210°

51. Consider the following statements in respect of the circuit shown in the given figure (assume ideal OP- AMP)



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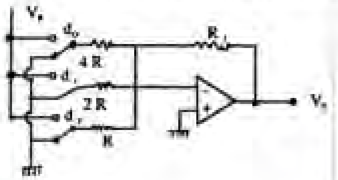
1. The common mode input impedance is 1/2 MΩ
2. The differential mode input impedance is 2 MΩ.
3. The differential mode gain is 50.
4. The common mode gain is zero.

Of these statements

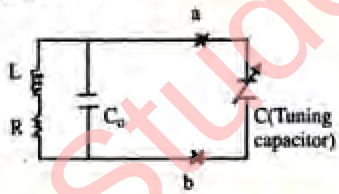
a. 1, 2, 3 and A are correct
b. 1, 2 and 3 are correct
c. 2, 3 and 4 are correct
d. 1 and 4 are correct

52. A 3-bit weighted resistor DAC shown in the figure has $V_R = 2V$ and $R_1/R = 2$. For an input of 100 the output will be



a. – 2V
b. – 4V
c. 2V
d. 4 V

53. In the given circuit, C_0 is the distributes capacitance of the coil and C is the tuning capacitor. If $C = C_1$ for the fundamental frequency and $C = C_2$ for the second harmonic, then the value of C_0 can be expressed as



a. $C_0 = \frac{C_1 - 2C_2}{3}$

b. $C_0 = \frac{C_1 - 4C_2}{3}$

c. $C_0 = \frac{C_1 - C_2}{3}$

d. $C_0 = C_1 - 2C_2$

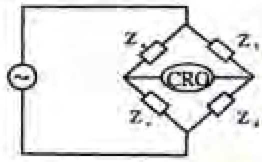
54. Given

$Z_a = 100\angle 50^\circ$

$Z_b = 300\angle -90^\circ$

$Z_c = 200\angle 0^\circ$

The value of Z_d for the bridge shown in the figure to be balanced is



a. $600\angle -40^\circ$
b. $600\angle 140^\circ$
c. $600\angle -140^\circ$
d. $150\angle 40^\circ$

55. For the ac bridge circuit shown in the figure, at balance, the value of R_d, L_d and Q_d will be respectively:

a. $\frac{R_a}{R_c}R_b; \frac{R_a R_c}{C_b}; \omega C_b R_b$

b. $\frac{R_b}{R_a}R_c; \frac{R_a R_c}{C_b}; \omega C_b R_b$

c. $\frac{R_b}{R_a}R_c; R_a R_c C_b; \omega C_b R_c$

d. $\frac{R_a}{R_b}R_c; R_a R_c C_b; \omega C_b R_b$

56. Wagner s earth devices are used in ac bridge circuits to

a. Eliminate the effect of ear the capacitance
b. Eliminate the effect of inter-component capacitances
c. Eliminate th4 effect of stray electrostatic fields
d. Shield the bridge elements

57. An LVDT is used to measure displacement. The output of the LVDT is connected to a voltmeter of range 0 to 5 V through an amplifier having a gain of 250. For a displacement of 0.5 mm, the output to the LVDT is 2 mV The sensitivity of the instrument would be;

a. 0.1 V/m
b. 0.5 V/mm

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c. 1 V/mm

d. 5 V/mm

58. It is required to measure temperature in the range of 1300°C to 1500° C. The most suitable thermocouple to be used as a transducer would be

a. Chromel – constantan

b. Iron – constantan

c. Chromel – alumel

d. Platinum –rhodium

59. Strain sensing transducers are made of various materials in- various sizes and shapes. The sensitivity of a strain gauge is expressed in terms of a gauge factor. For a certain application, a gauge factor of 100 is desired. The proper strain gauge to be used in this case would be

a. Constantan strain gauge

b. Nichrome - V strain gauge

c. Semiconductor strain gauge

d. Platinum - tungsten alloy strain gauge

60. An angular position is to be measured using a transducer. Which of the following types of transducers can be used for this purpose?

1. Circular potentiometer

2. LVDT

3. E - pick off.

4. Synchro.

Select the correct answer using the codes given below:

Codes:

a. 1, 2, 3 and 4

b. 2 and 3

c. 1, 2 and 4

d. 1 and 4

61. Bridge circuits using resistance temperature detectors (RTD's) in temperature measurements usually employ the "three lead system" so as to obtain

a. Higher sensitivity

b. Better impedance matching

c. Compensation for the signal wire resistance to the detector

d. Reduction in power consumption

62. Which one of the following additional devices is required in order to measure pressure using LVDT?

a. Strain gauge

b. Bourden tube

c. Bourden tube

d. Rotameter

63. A resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structural member subjected to a tensile stress of 100 mega Newtons/metre^2. The modulus of elasticity of steel is 200 Giga Newtons per square meter. The percentage change in gauge resistance due to the applied stress is

a. 0.1

b. 0.2

c. 0.4

d. 0.5

64. A variable reluctance type tachometer has 180 teeth on rotor. The speed of the shaft on which it is mounted is 1200 rpm. The frequency of the output pulses is

a. 1800 per second

b. 3600 per second

c. 4800 per second

d. 5600 per second

65. The Q factor of an inductor would be higher if it is made of

a. Thinner wire

b. Longer wire

c. Shorter wire

d. Thicker wire

66. The coding system typically used in digital telemetry is

a. PPM (Pulse position modulation)

b. PAM (Pulse amplitude modulation)

c. PCM (Pulse code modulation

d. PDM (Pulse duration modulation)

67. **Assertion (A):** In Hall effect, the open circuit transverse voltage developed by a current – carrying semiconductor with a steady magnetic field' imposed perpendicular to the current direction has opposite signs for n-type and P-type semiconductors.

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Reason (R): The magnetic field pushes both the holes and the conduction electrons in the same direction.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

68. **Assertion (A):** At high temperatures, the avalanche breakdown voltage is higher.

Reason (R): At high temperatures mean free paths of electrons and holes are shorter, therefore a larger field is required to cause ionization.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

69. The transfer function of an active network with gain 'K' is given by:

$$\frac{V_2(s)}{V_1(s)}=\frac{K}{s^2C^2R^2+sCR(3-K)+1}$$

Assertion (A): The network is unstable for all values of K.

Reason (R): The poles of the network function depend on the parameter K.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

70. **Assertion (A):** For a non - dynamic linear time - invariant system, the output equation in its state variable description simplifies to Y = Du. Where D is a constant matrix and Y and u are the output and input vectors respectively.

Reason (R): The state vector X is zero for a non - dynamic system.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

71. **Assertion (A):** For a linear time- invariant system, more than one choice may exist for the state vector but the system matrix 'A' would be the same for all the choices.

Reason (R): The 'A' matrix uniquely determines the system characteristic equation. Which should be the same irrespective of the choice of the state vector.

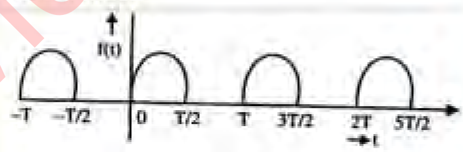
a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

72. **Assertion (A):** For the half - wave rectified sine wave f (t) shown in the figure, the only sine term present in its trigonometric form of Fourier series is the fundamental.



Reason (R): The odd part of f(t) is a pure sinusoid of the fundamental frequency.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

73. **Assertion (A):** A linear, time - invariant discrete – time system having the system function $H(z)=\frac{z}{z+\frac{1}{2}}$ is a stable system.

Reason (R): The pole of H (z) is in the left- half plane for a stable system.

a. Both A and R are true and R. is the correct explanation of A

b. Both A and R are true but R is NOT a correct explanation of A

c. A is true but R is false

d. A is false but R is true

74. Match List - I (Crystal type) with List - II (Name of the solid) and select the correct

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answer using the codes given below the Lists:

List I

A. Ionic

B. Covalent

C. Metallic

D. Van der Waal's

List II

1. Solid argon
2. Copper
3. Silicon
4. Sodium chloride

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

75. Match List -I (Material) with List -II (Electrical conductivity in mho/m) and select the correct answer using the codes given below the Lists:

List I

A. Copper

B. Aluminum

C. Nickel

List II

1. 2×10^7
2. 1.03×10^7
3. 3.5×10^7

Codes:

	A	B	C
a.	3	1	2
b.	1	3	2
c.	3	2	1
d.	1	2	3

76. The carrier mobility in a semiconductor is $0.4\ m^2/Vs$. Its diffusion constant at 300 K will be (in M^2/s)

a. 0.43

b. 0.16

c. 0.04

d. 0.01

77. In a piezoelectric crystal, application of a mechanical stress would produce

a. Plastic deformation of the crystal

b. Magnetic dipoles in the crystal

c. Electrical polarization in the crystal

d. Shift in the Fermi level

78. The relative dielectric constant of barium titan ate at 100°C is about

a. 1

b. 5

c. 50

d. 2000

79. Consider the following materials:

1. Nickel
2. Silver
3. Oxygen
4. Aluminum

The correct sequence of these materials in DECREASING order of their magnetic permeability is

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

80. A vacuum parallel plate capacitor is charged. The field between the plates is 2×10^4 V/m. if the space between the plates is filled with a material of relative dielectric constant of 10.0, then the value of the field in the dielectric will be

a. $2\times10^3 V/m$

b. $\frac{2}{\sqrt{10}}\times10^4 V/m$

c. $2\times\sqrt{10}\ 10^4 V/m$

d. $2\times10^5 V/m$

81. Some ceramic superconductors become superconducting

a. Below liquid helium temperature

b. Between liquid helium and liquid nitrogen temperatures

c. Above liquid nitrogen temperature but below room temperature

d. Above room temperature

82. Ga As has an energy gap of 1.43 eV The optical cut - off wavelength of Ga As would lie in the

a. Visible region of the spectrum

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b. Infrared region of the spectrum

c. Ultraviolet region of the spectrum

d. Far ultraviolet region of the spectrum

83. The real parts of the relative dielectric constant and loss tangent of Teflon are 2.1 and 5×10^{-4} at 100 Hz respectively. The imaginary part of the dielectric constant at 100 Hz is

a. 1.05×10^{-3}

b. 2.1×10^{-3}

c. 5×10^{-3}

d. 1.05×10^{-2}

84. If the critical magnetic field for aluminum is 7.9×10^{3} amp/turn, then the current flowing through a long thin wire of aluminum of diameter 10^{-3} m will be

a. 25 amp

b. 50 amp

c. 100 amp

d. 1000 amp

85. At very high temperatures, the extrinsic semiconductors become intrinsic because

a. Of drive- in diffusion of do pants and carriers

b. Band to band transition dominates over impurity ionization

c. Impurity ionization dominates over band to band transition

d. Band to band transition is balanced by impurity ionization

86. Which of the following elements act as donor impurities?

1. Gold
2. Phosphorus
3. Boron
4. Antimony
5. Arsenic
6. Indium.

Select the correct answer using the codes given below:

Codes:

a. 1, 2 and 3

b. 1, 2, 4 and 6

c. 3,4,5and 6

d. 2,4 and 5

87. Consider the following statements regarding a semiconductor:

1. Acceptor level lies close to the valence band.
2. Donor level lies close to the valence band
3. n-type semiconductor behaves as a conductor at zero Kelvin.
4. p-type semiconductor behaves as an insulator at zero Kelvin

Of these statements

a. 2 and 3 are correct

b. 1 and 3 are correct

c. 1 and 4 are correct

d. 3 and 4 are correct

88. In a p - n junction, the space charge capacitance is proportional to V^{-n} where V is the applied bias voltage and 'n' is a constant.

The value of 'n' for step, linearly graded and diffused junctions would be respectively

a. $\frac{1}{2}, \frac{1}{3}, \frac{1}{2.5}$

b. $\frac{1}{3}, \frac{1}{2}$ *and* $\frac{1}{2.5}$

c. $\frac{1}{2}, \frac{1}{2.5}$ *and* $\frac{1}{3}$

d. $\frac{1}{3}, \frac{1}{2.5}$ *and* $\frac{1}{2}$

89. Match List- I (Models of BJT) with -II (Applications) and select the correct answer using the codes given below the Lists:

List I

A. Hybrid model

B. Hybrid pi-model

C. S. parameter model

D. Ebers- Moll model

List II

1. Microwave measurements
2. Coupled diode
3. Low frequency
4. High frequency

Codes:

A	B	C	D

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a.	4	3	1	2
b.	3	4	2	1
c.	3	4	1	2
d.	4	3	2	1

90. What is the correct sequence of the following steps in the fabrication of a monolithic, bipolar junction transistor?

1. Emitter diffusion
2. Base diffusion
3. Buried layer formation
4. Epi - layer formation.

Select the correct answer using the codes given below:

Codes:

a. 3, 4, 1, 2
b. 4, 3, 1, 2
c. 3, 4, 2, 1
d. 4, 3, 2, 1

91. The threshold voltage of an n - channel enhancement mode MOSFET is 0.5 V. when the device is biased at a gate voltage of 3 V, pinch - off would occur at a drain voltage of

a. 1.5V
b. 2.5V
c. 3.5V
d. 4.5V

92. The zero gate bias channel resistance of a junction field effect transistor is 750 ohms and the pinch - off voltage is 3 V. For a gate bias of 1.5 V and very low drain voltage, the device would behave as a resistance of

a. 320 ohms
b. 816 ohms
c. 1000 ohms
d. 1270 ohms

93. Consider the following statements:

The turn - off time of an SCR can be reduced by

1. Quick withdrawal of the gate voltage..
2. Reducing life - time by doping with gold.
3. Applying a negative voltage pulse to the gate.

Of these statements

a. 1, 2 and 3 are correct
b. 1 and 2 are correct
c. 1 and 3 are correct
d. 2 and 3 are correct

94. In a wafer, a junction depth of x_1 is achieved by a constant source diffusion process of 1 hour diffusion time. How long should the diffusion process continue, if a junction depth of $2x_1$ is to be achieved?

a. 2 hours
b. 4 hours
c. 5 hours
d. 7 hours

95. For a photo induced current I_L, the collector current of a phototransistor will be

a. $(h_{fe}+1)I_L$
b. $\frac{I_L}{h_{fe}+1}$
c. $h_{fe}I_L$
d. $\frac{I_L}{h_{fe}}$

96. Given that the band gap of cadmium sulphide is 2.5 eV, the maximum photon for e1ectron-holepair generation will be

a. 5400 μm
b. 540 μm
c. 5400 Å
d. 540 Å

97. A dc current source is connected as shown in Fig. I:

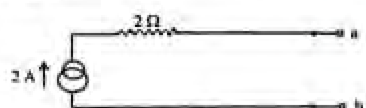
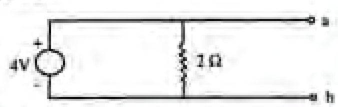


Fig. I

The Theremin's equivalent of the network at terminals a-b

a. Will be



b. Will be

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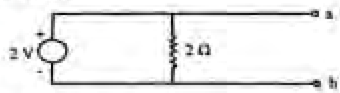
c. Will be



d. Is NOT feasible

98. A battery charger can drive a current of 5 A into a 1ohm resistance connected at its output terminals. If it is able to charge an ideal 2V battery at 7A rate, then its Thevenin's equivalent will be

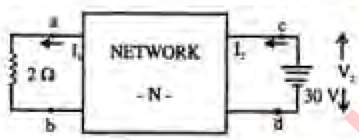
a. 7.5 V in series with 0.5 ohm

b. 12.5 V in series with 1.5 ohms

c. 7.5 V in parallel with 0.5 ohm

d. 12.5 V in parallel with 1.5 ohms

99. Two sets of measurements on a linear passive two - port network are shown in the following figures:



The current flowing through the 2 - ohm resistor is

a. 2A

b. 1A

c. 0.5 A

d. zero

100. For a connected planar graph of 'V' vertices and 'e' edges, the number of meshes is

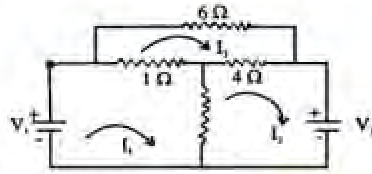
a. e – v

b. v – 1

c. e – v – 1

d. e – v + 1

101. A network is shown in the given figure. Which one of the following equations would represent the equation for loop 3?



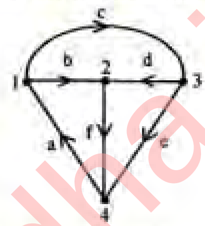
a. $-I_1 + 4I_2 + 11I_3 = 0$

b. $I_1 + 4I_2 + 11I_3 = 0$

c. $-I_1 - 4I_2 + 11I_3 = 0$

d. $I_1 + 4I_2 + 6I_3 = 0$

102. For the graph shown in the given figure, one set of fundamental cut-sets would be



a. abc, cde, afe

b. afdc, cde, abde

c. cbfe, afe, bdf

d. cbd, abde, cde

103. A particular current is made up of two components: a 10 A dc and a sinusoidal current of peak value of 14.14 A. The average value of the resultant current is

a. Zero

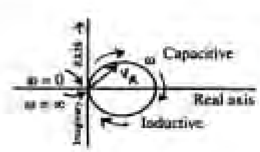
b. 24.14 A

c. 10A

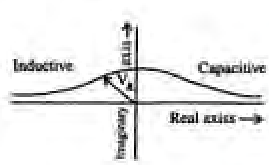
d. 14.14A

104. The locus of the tip of the voltage phasor (V_R) across the resistance (R) in series RLC resonant circuit is given by

a.



b.



c.

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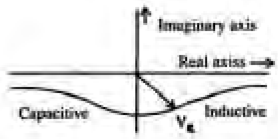
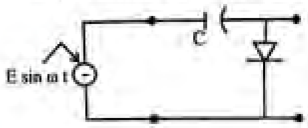
d.



105. In the circuit given, the voltage across the diode (assumed to be an ideal one) is:



a. Zero

b. – E + E sin ωt

c. E – E sin ωt

d. Half sinusoids

106. Match List - I with List - II and select the correct answer using the codes given below the lists:

List I

A. Bridged T-network

B. Twin T-network

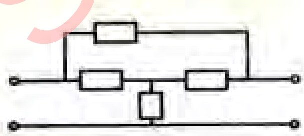
C. Lattice network

D. Ladder network

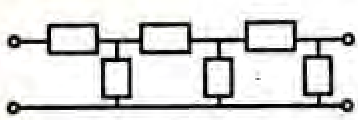
List II

1.

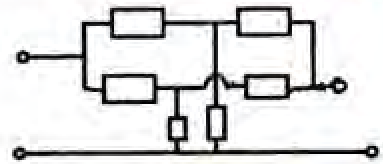
2.



3.



4.



Codes:

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

107. In respect of the 2-port network shown in the figure, the admittance parameters are: $Y_{11} = 8\ mho, Y_{12} = Y_{21} = 6\ mho\ and\ Y_{22} = mho$

The values of Y_A, Y_B and Y_C (in units of mho) will be respectively

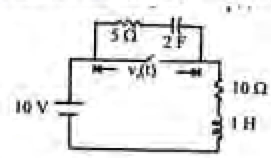
a. 2, 6 and – 6

b. 2, 6 and 0

c. 2,0 and 6

d. 2,6 and 8

108. In the network shown, the switch is opened at t = 0. Prior to that, the network was in the steady - state. v_s (t) at t = 0^+ is.



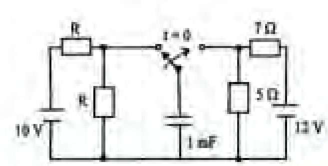
a. 0

b. 5V

c. 10V

d. 15V

109. In the network shown in the figure, the switch had remained closed for a long time on the 10 V source side. If at time t = 0, it is changed to the 12V side, then after one time constant, the voltage across 5Ω in the circuit will be



a. 5V

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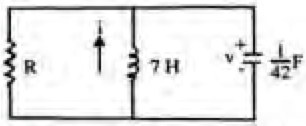
b. $5e^{-1}V$

c. 10 V

d. 12V

110. For the circuit shown in the figure, the value or R for critical damping will be



a. 10.5 ohm

b. 6 ohm

c. 3.5 ohm

d. 3 ohm

111. The transfer function,

$T(s) = \frac{s}{s+a}$ is that of

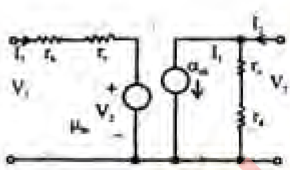
a. Low - pass filter

b. Notch filter

c. High - pass filter

d. Band- pass filter

112. The model of a transistor in the commonemtter connection is shown in the following figure:



Match List - I (Parameters) with list - II (Values) and select the correct answer using the codes given below the lists:

List I

A. h_{22}

B. h_{11}

C. h_{21}

List II

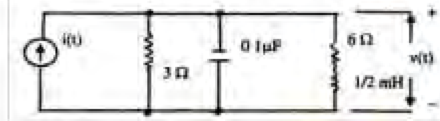
1. $r_b + r_e$

2. α_{cb}

3. $\frac{1}{r_c + r_d}$

	A	B	C
a.	3	1	2
b.	1	3	2
c.	2	3	1
d.	3	2	1

113. In the circuit shown, i(t) is a unit step current. The steady-state value of v (t) is



a. 2v

b. 3v

c. 6v

d. 9v

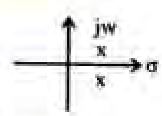
114. The pole locations of three network and their impulse responses h(t) are shown in List I with List-II respectively. Match List I with List II and select the correct answer

List I

A.

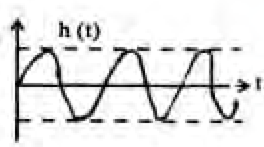
B.

C.

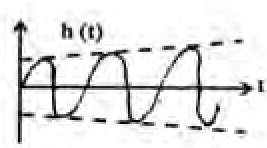


List II

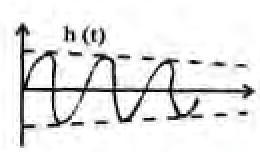
1.



2.



3.



	A	B	C
a.	1	2	3

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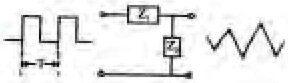
b.	2	1	3
c.	3	1	2
d.	3	2	1

115. Z_1 and Z_2 in the figure shown represent L, C or R. For the transformation of a square wave of period 'T' into a triangular wave. The values of Z_1, Z_2 and L/R or RC as the case may be, should be



a. $Z_1 = R, Z_2 = L \; and \; \frac{L}{R} << T$

b. $Z_1 = L, Z_2 = R \; and \; \frac{L}{R} << T$

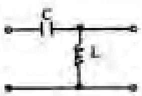
c. $Z_1 = R, Z_2 = C \; and \; RC >> T$

d. $Z_1 = C, Z_2 = R \; and \; RC << T$

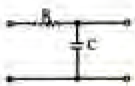
116. Match List - I with List - II and select the correct answer using the codes given below the Lists:

List I

A.



B.



C.

D.

List II

1. Band reject (notch) filter
2. Band - pass filter
3. High - pass filter
4. Low - pass filter

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

117. Consider the following from the point of view of possible realization as driving - point impedances using passive elements:

1. $\frac{1}{s(s+5)}$
2. $\frac{s+3}{s^2(s+5)}$
3. $\frac{s^2+3}{s^2(s^2+5)}$
4. $\frac{s+5}{s(s+3)}$

Among these

a. 1, 2 and 4 are realizable

b. 1, 2 and 3 are realizable

c. 3 and 4 are realizable

d. None is realizable

118. An RC driving - point impedance function has zeros at s = –2 and s = –5. The admissible poles for the function would be

a. s = 0; s = –6

b. s = –1; s = –3

c. s = 0 ; s = –1

d. s = –3; s = –4

119. Two networks are cascaded through an ideal buffer. If t_{d1} and t_{d2} are the delay times of the networks, then the overall delay of the tow networks together will be

a. $\sqrt{t_{d1}t_{d2}}$

b. $\sqrt{t_{d1}^2 + t_{d2}^2}$

c. $t_{d1} + t_{d2}$

d. $\frac{t_{d1} + t_{d2}}{2}$

120. Two networks are cascaded through an ideal buffer. If t_{r1} and t_{r2} are the rise times of the two network, then the overall rise time of the two networks together will be

a. $\sqrt{t_{r1}t_{r2}}$

b. $\sqrt{t_{r1}^2 + t_{r2}^2}$

c. $t_{r1} + t_{r2}$

d. $\frac{t_{r1} + t_{r2}}{2}$

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