

## ELECTRONICS &amp; TELECOMMUNICATION ENGINEERING

## PAPER-I

1. Match List I with List II and select the correct answer:

List I (Functions)

- A.  $\exp(-\alpha t) u(t)$ ,  $\alpha > 0$   
 B.  $\exp(\alpha |t|)$ ,  $\alpha > 0$   
 C.  $t \exp(-\alpha t) u(t)$ ,  $\alpha > 0$   
 D.  $\exp(j 2\pi \alpha t/t_0)$

List II (Fourier transforms)

1.  $\frac{1}{(\alpha + j2\pi f)^2}$

2.  $\frac{1}{\alpha + j2\pi f}$

3.  $\delta\left(f - \frac{\alpha}{t_0}\right)$

4.  $\frac{2\alpha}{\alpha^2 + (2\pi f)^2}$

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

2. Match List I with List II and select the correct answer :

List I (Type of signal)

- A. Real and even symmetric  
 B. Real and odd symmetric  
 C. Imaginary and even symmetric  
 D. Imaginary and odd symmetric

List II (Property of Fourier transform)

1. Imaginary and even symmetric  
 2. Real and even symmetric  
 3. Real odd symmetric  
 4. Imaginary and odd symmetric

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

3. Consider the following statements :

1. Fourier transform is special case of Laplace transform  
 2. Region of convergence need not be specified for Fourier transform  
 3. Laplace transform is not unique unless the region of convergence is specified  
 4. Laplace transform is a special case of Fourier transform

Which of these statements are correct?

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

4. The response of a linear, time-invariant, discrete-time system to a unit step input  $u(n)$  is the unit impulse  $\delta(n)$ . The system response to a ramp input  $n u(n)$  would be

- a.  $u(n)$   
 b.  $u(n-1)$   
 c.  $n \delta(n)$   
 d.  $\sum_{k=0}^{\infty} k \delta(n-K)$

5. If  $X(Z) = \frac{z+z^{-3}}{z+z^{-1}}$  then  $x(n)$  series has

- a. alternate 0s  
 b. alternate 1s  
 c. alternate 2s  
 d. alternate -1s

6. For a Z-transform

$$X(z) = \frac{z\left(2z - \frac{5}{6}\right)}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{3}\right)}$$

Match List I (The sequences) with List II (The region of convergence) and select the correct answer

List I

- A.  $[(1/2)^n + (1/3)^n] u(n)$   
 B.  $(1/2)^n u(n) - (1/3)^n u(-n-1)$   
 C.  $-(1/2)^n u(-n-1) + (1/3)^n u(n)$   
 D.  $-(1/2)^n + (1/3)^n] u(-n-1)$

## List II

1.  $(1/3) < |z| < (1/2)$
2.  $|z| < (1/3)$
3.  $|z| < 1/3$  and  $|z| > 1/2$
4.  $|z| > 1/2$

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

7. A system can be represented in the form of state equations as

$$\underline{S}(n+1) = A \underline{S}(n) + Bx(n)$$

$$y(n) = C \underline{S}(n) + Dx(n)$$

Where A, B, C and D are matrices,  $\underline{S}(n)$  is the state vector.  $x(n)$  is the input and  $y(n)$  is the output. The transfer function of the system  $H(z) = Y(z)/X(z)$  is given by

- a.  $A(ZI - B)^{-1}C + D$
- b.  $A(ZI - C)^{-1}D + A$
- c.  $C(ZI - A)^{-1}B + D$
- d.  $D(ZI - A)^{-1}C + B$

8. Match List I (Fourier series and with Fourier transforms) List II (Their properties) and select the correct answer :

## List I

- A. Fourier series
- B. Fourier transform
- C. Discrete time Fourier transform
- D. Discrete Fourier transform

## List II

1. Discrete, periodic
2. Continuous, periodic
3. Discrete, a periodic
4. Continuous, a periodic

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

9. The units of the spectrum obtained by Fourier transforming the covariance function of a stationary stochastic process is

- a. energy per Hertz
- b. power per Hertz
- c. energy per second

- d. power per second

10. Two independent random signals X and Y are known to be Gaussian with mean values  $x_0$  and  $y_0$  and variance  $\sigma_x^2$  and  $\sigma_y^2$ . A signal  $Z = X - Y$  is obtained from them. The mean  $z_0$ , variance  $\sigma_z^2$  and p.d.f.  $p(z)$  of the signal Z are given by

- a.  $x_0 - y_0, \sigma_x^2 + \sigma_y^2$ , Gaussian
- b.  $x_0 + y_0, \sigma_x^2 + \sigma_y^2$ , Rayleigh
- c.  $y_0 - x_0, \sigma_y^2 - \sigma_x^2$ , uniform
- d.  $x_0 - y_0, \sigma_x^2 + \sigma_y^2$ , Gaussian

11. If the cumulative distribution function is  $F_x(x)$ , then the probability density function  $f_x(x)$  is given as

- a.  $\int F_x(x) dx$
- b.  $d/dx F_x(x)$
- c.  $\int F_x(-x) dx$
- d.  $d/dx F_x(-x)$

12. The maximum power that a 12 V d.c. source with an internal resistance of 2  $\Omega$  can supply to a resistive load is

- a. 12 W
- b. 18 W
- c. 36 W
- d. 48 W

13. Consider the following statements associated with the superposition theorem :

1. It is applicable to d.c. circuits only
2. It can be used to determine the current in a branch or voltage across a branch
3. It is applicable to networks consisting of more than one source
4. It is applicable to networks consisting of linear and bilateral elements

Which of these statements are correct ?

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

14. The Fourier transform of  $e^{-\pi t^2}$  is  $e^{-\pi f^2}$ ; then the Fourier transform of  $e^{-at^2}$  is :

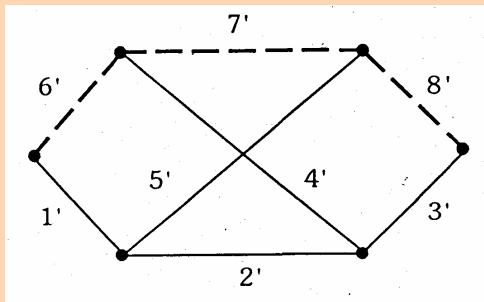
- a.  $\left(\frac{1}{a}\right)e^{-\pi f^2}$

b.  $\sqrt{\frac{\pi}{\alpha}} e^{-\frac{\pi^2 f^2}{\alpha}}$

c.  $\frac{1}{\sqrt{\pi\alpha}} e^{-\pi^2 f^2}$

d.  $\sqrt{\pi\alpha} e^{-\frac{f^2}{\pi^2\alpha}}$

15. Figure given below shows a graph with 6 vertices and 8 edges.



With reference to the above graph, match List I with List II and select the correct answer :

List I

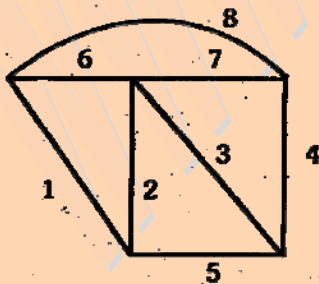
- A. Fundamental circuit of chord 6'  
B. Fundamental circuit of chord 7'  
C. Fundamental circuit of chord 8'

List II

1. The edge set  $(1', 2', 4', 6')$   
2. The edge set  $(2', 4', 5', 7')$   
3. The edge set  $(2', 3', 5', 8')$   
4. The edge set  $(1', 2', 4', 7')$   
5. The edge set cannot be determined

	A	B	C
a.	1	2	3
b.	4	3	2
c.	2	3	4
d.	2	5	3

16. In the graph shown in the figure, one possible tree is formed by the branches 4, 5, 6, 7 :



Then one possible fundamental loop is

- a. 1, 4, 5  
b. 2, 3, 5

- c. 3, 4, 8

- d. 6, 7, 8

17. Which one of the following statements is NOT a property of R - L driving point impedance?

- a. The first critical frequency at the origin is a zero  
b. The last critical frequency is a pole  
c. The impedance at  $S = \infty$  is always less than the impedance at  $S = \text{zero}$   
d. The slope of the impedance curve is positive at all points

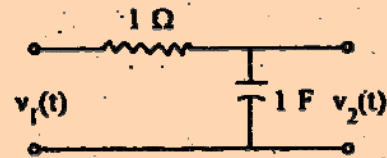
18. In a network containing resistances and reactances the roots of the characteristic equation give for the circuit

- a. the force response  
b. the total response  
c. the natural response  
d. the damped response

19. A series RL circuit is initially relaxed. A step voltage is applied to the circuit. If  $\tau$  is the time constant of the circuit, the voltage across R and L will be the same at time t equal to

- a.  $\tau \ln 2$   
b.  $\tau \ln\left(\frac{1}{2}\right)$   
c.  $1/\tau \ln 2$   
d.  $1/\tau \ln\left(\frac{1}{2}\right)$

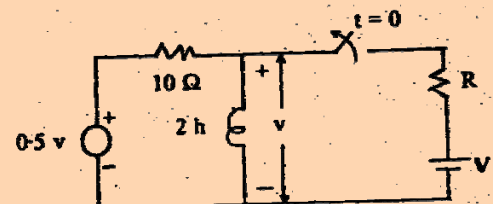
20. For the following circuit a source of  $V_1(t) = e^{-2t}$  is applied.



Then the resulting response  $v_2(t)$  is given by

- a.  $e^{-2t} + e^{-t}$   
b.  $e^{-t}$   
c.  $e^{-t} - e^{-2t}$   
d.  $e^{-2t}/2$

- 21.



The time constant of the circuit after the switch shown in the figure is opened is

- 0.2 s
- 5 s
- 0.1 s
- dependent on R and hence cannot be determined unless R is known

22. Match List I with list II and select the correct answer:

List I

- A series RLC circuit is overdamped when
- The unit of the real part of the complex frequency is
- If  $F(s)$  is the Laplace transform of  $f(t)$  then  $F(s)$  and  $f(t)$  are known as
- If  $1(t)$  and its first derivative are Laplace transferable then the initial value of  $f(t)$  is given by

List II

- $f(t) = s F(s)$   
 $\lim_{t \rightarrow 0} \lim_{s \rightarrow \infty}$
- $R^2/4L^2 < 1/LC$
- rad/s
- inverse functions
- $R^2/4L^2 > 1/LC$
- neper  $\text{sec}^{-1}$
- $f(t) = s F(s)$   
 $\lim_{t \rightarrow 0} \lim_{s \rightarrow 0}$
- transform pairs

	A	B	C	D
a.	5	6	8	1
b.	5	6	1	8
c.	6	5	3	4
d.	6	5	2	7

23. Consider the following :

Energy storage capability of basic passive elements is due to the fact that

- resistance dissipates energy
- capacitance stores energy
- inductance dissipates energy

Which of the above is/are correct?

- 1, 2 and 3
- 1 and 3
- 3 alone
- 1 and 2

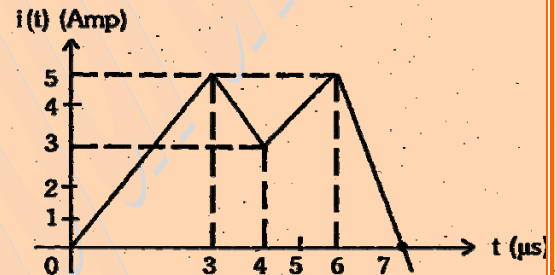
24.  $\sqrt{\frac{L}{C}}$  has the dimension of

- time
- capacitance
- inductance
- resistance

25. A network  $N'$  is a dual of network  $N$  if

- both of them have same mesh equations
- both of them have the same node equations
- mesh equations of one are the node equations of the other
- KCL and KVL equations are the same

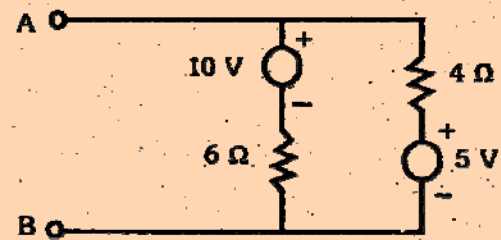
26. A current  $i(t)$  as shown in the figure is passed through a capacitor.



The charge (in micro-coulomb) acquired by the capacitor after 5 μs is

- 7.5
- 13.5
- 14.5
- 15

27.

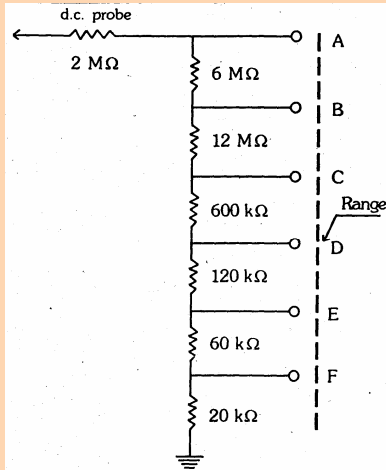


In the circuit given above, viewed from AB, the circuit can be reduced to an equivalent circuit as

- 5 Volt source in series with 10 Ω resistor
- 7 Volt source in series with 2.4 Ω resistor
- 15 Volt source in series with 2.4 Ω resistor
- 1 Volt source in series with 10 Ω resistor

28. A certain oscilloscope, with 4 cm by 4 cm screen has its own sweep output fed to its input. If the x and y sensitivities are same, the oscilloscope will display a
- saw-tooth wave
  - triangular wave
  - diagonal line
  - horizontal line

29.



The figure shows input attenuator of a multimeter. The meter reads full-scale with 12 V at M with the range switch at position B. What is the required voltage at M to obtain full-scale deflection with the range switch position at D?

- 1 V
  - 150 V
  - 120 V
  - 147 V
30. Match List I with List II and select the correct answer:

List I (Measuring bridge)

- Kelvin Double Bridge
- Wien Bridge
- Schering Bridge
- Maxwell's Bridge

List II (Application)

- Capacitance
- Self inductance
- Frequency
- Low resistance

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

31. Match List I with List II and select the correct answer:

List I (Transducers)

- Venturi tube
- Optical tachometer
- Linear variable differential transformer
- Pirani gauge

List II (Measured Quantities)

- Displacement
- Pressure
- Flow
- Velocity

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

32. Rochelle salt is a crystalline material used in producing

- velocity transducer
- photoelectric transducer
- piezoelectric transducer
- differential transformer transducer

33. The gauge factor of the material of strain, gauge is such that the resistance changes from 1000 ohms to 1009 ohms when subjected to a strain of 0.0015. The Poisson's ratio for the material of the gauge wire is

- 1.75
- 2
- 2.5
- 6

34. Consider the following statements in connection with the null or balance condition in a bridge circuit:

- It is always independent of the magnitude of the source voltage or its impedance.
- It is independent of the sensitivity of the detector or its impedance.
- It is unchanged if the impedances of one set of adjacent arms are interchanged.
- It is unchanged if the source and the detector are interchanged.

Which of these statements are correct ?

- 1, 2 and 3



- b. 1, 2 and 4
- c. 2, 3 and 4
- d. 1, 3 and 4

35. Consider the following statements regarding a moving coil instrument :

1. The sensitivity of a moving coil voltmeter is specified in terms of ohms per volt.
2. A higher range moving coil voltmeter has higher sensitivity.
3. A higher current moving coil instrument has higher sensitivity.
4. Higher sensitivity meters give more reliable results.

Which of these statements are correct ?

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

36. Consider the following statements in connection with measurement of frequency/time interval using a digital frequency counter.

1. Period measurements are preferred over frequency measurements at lower frequencies due to 'gating error' of  $\pm 1$  count ambiguity.
2. The error in time-interval and period measurements due to trigger level uncertainty can be reduced with large signal amplitudes and fast rise times.
3. Short-term frequency stability errors can be minimized by taking frequency measurement over long gate times.
4. Long - term frequency stability errors are generally negligible since they tend to average out.

Which of these statements are correct ?

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

37. The common mode error voltage in a DVM can be eliminated by using at its input

- a. a differential amplifier
- b. a wide band amplifier
- c. a tuned amplifier
- d. a low-pass filter

38. A sinusoidal signal of frequency 2 kHz is applied to the x-deflection plates and a saw-tooth of frequency 1 kHz is applied to the y-deflection plates of a C.R.O. The waveform display on the screen will be

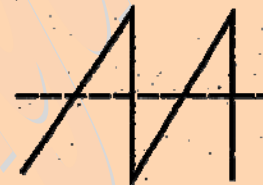
a.



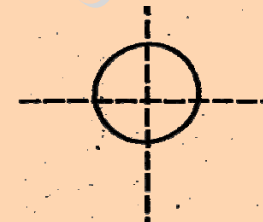
b.



c.



d.



39. Match List I with List II and select the correct answer :

List I (ADCs)

- A. Parallel-comparator
- B. Successive approximation
- C. Dual -slope
- D. Counter - ramp

List II (Characteristics)

1. Null balancing type
2. Fastest converter
3. Voltage-dependent conversion time
4. Integrating type

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

- d. 1 2 3 4
40. Consider the following statements in connection with DAC :
1. The resolution of a 10-bit DAC is nearly equal to 0.1% of its full-scale range.
  2. The linearity of a DAC depends principally on the accuracy of the resistors used.
  3. The R-2R ladder type DAC requires less number of resistors compared to weighted-resistor type of DAC.
  4. The output of a DAC should be monotonic.

Which of these statements are correct ?

- a. 1, 2 and 3
  - b. 1, 2 and 4
  - c. 2, 3 and 4
  - d. 1, 3 and 4
41. In an electro-dynamometer, a moving coil has an area A, turn N and carries a current I producing a magnetic flux B. The torque on the moving coil is proportional to
- a. I
  - b.  $I^2$
  - c.  $B.I^2$
  - d.  $A.N.B.I^2$
42. Assertion (A) : When an impurity is added to a pure metal, the residual resistivity at zero K is not zero.  
Reason (R) : At absolute zero temperature, lattice vibration ceases to exist.
- a. Both A and R are true & R is the correct explanation of A
  - b. Both A and R are 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
43. Assertion (A) : An insulating material can also be used as a good dielectric and vice versa.  
Reason (R) : An insulator does not allow d.c. current to pass through it while an electric field can.
44. Assertion (A) : Superconducting materials are not good conductors at room temperature as the normal metals are at room temperature.

Reason (R) : Superconductivity is observable only if the applied magnetic field is below the critical field.

45. Assertion (A) : The intrinsic Fermi level of a semiconductor does not lie exactly at the middle of the energy band gap.

Reason (R) : The densities of the available states in valance and conduction bands of a semiconductor are equal.

46. Assertion (A) : The diode current is controlled by minority carrier injection over a potential barrier. In the forward bias condition, the minority carriers are increased exponentially.

Reason (R) : At high forward bias, the electric field in the neutral regions is no longer negligible as the minority charge density approaches the majority charge density. The diode starts to behave like an ohmic device.

47. Assertion (A) : A bipolar junction transistor has high gain, high emitter efficiency and high speed.

Reason (R) : The transistor has heavy emitter doping and narrow base width.

48. Assertion (A) : The stability of the system is assured if the Region of Convergence (ROC) includes the unit circle in the Z-plane.

Reason (R) : For a causal stable system all the poles should be outside the unit circle in the Z-plane.

49. Assertion (A) : The signals  $a^n u(n)$  and  $a^n u(-n-1)$  have the same Z-transform,  $\frac{Z}{Z-a}$ .

Reason (R) : The Region of Convergence (ROC) for  $a^n u(n)$  is  $|z| > |a|$ , whereas the ROC for  $a^n u(-n-1)$  is  $|z| < |a|$ .

50. Assertion (A) : For a rational transfer function  $H(z)$  to be causal, stable and causally invertible, both the zeros and the poles should lie within the unit circle in the Z-plane.

Reason (R) : For a rational system, ROC is bounded by poles.

51. Assertion (A) : When a sinusoidal voltage is switched on to a circuit consisting of R-L-C elements, the response consists of two components expressed by free response and force response.

Reason (R) : The response at  $t = 0_+$  is called free response as the voltage was just then switched and the one at  $t = \text{very large}$  is forced response as it consists of values of  $R$ ,  $L$ ,  $C$ , applied voltage and its frequency.

52. Assertion (A) : The greater the 'Q', the smaller the bandwidth of a resonant circuit.

Reason (R) : At high frequencies the Q of a coil falls due to skin effect.

53. Assertion (A) : A series  $R_1 - L$  and a series  $R_2 - C$  are connected in parallel. Parallel resonance will occur at all frequencies when  $R_1^2 = R_2^2 = L/C$ .

Reason (R) : An inductor must be operated below the self-resonant frequency.

54. Assertion (A) = For an E.M. wave normally incident on a conductor surface the magnetic field  $\vec{H}$  undergoes a  $180^\circ$  phase reversal and the phase of electric field  $\vec{E}$  remains same.

Reason (R) : The direction of propagation of an incident wave will reverse after striking a conductor surface.

55. Assertion (A) : A  $\lambda/4$  short circuited line behaves as a series resonant circuit.

Reason (R) : At a particular frequency the input impedance becomes infinite.

56. Assertion (A) : Use of post deflection acceleration (PDA) in a CRT increases the luminance of electron beam.

Reason (R) : Luminance is a function of physical characteristics of the phosphor used for the screen.

57. A field  $\vec{A} = 3x^2yz\vec{a}_x + x^3z\vec{a}_y + (x^3y - 2z)\vec{a}_z$

can be termed as

- Harmonic
- Divergence less
- Solenoidal
- Rotational

58. Consider the following :

For a lossless transmission line we can write :

- $Z_{in} = -j Z_0$  for a shorted line with  $l = \lambda/8$
- $Z_{in} =$  for a shorted line with  $l = \lambda/4$

- $Z_{in} = -j Z_0$  for an open line, with  $l = \lambda/2$

- $Z_{in} = Z_0$  for a matched line of any length

Select the correct answer using the codes given below:

- 1 and 2
- 2 and 3
- 1 and 3
- 2 and 4

59. The input impedance of a short circuited quarter wave long transmission line is

- purely reactive
- purely resistive
- dependent on the characteristic impedance of the line
- none of the above

60. The current distribution along a travelling wave antenna can be written, in the form

- $I(z) = I_0 e^{-j\beta z}$
- $I(z) = I_0 \sin \beta z$
- $I(z) = I_0$
- $I(z) = I_0 \cos (\omega t - \beta z)$

61. Match List I with List II and select the correct answer :

List I

- Propagation constant
- Radiation intensity
- Wave impedance

List II

- $\sqrt{\omega\mu\sigma/2}$
- $r^2 / 2\eta (|E|^2)$
- $E_t / H_t$
- $\vec{E} \times \vec{H}$

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

62. For a wave propagating in an air filled rectangular waveguide

- guided wavelength is never less than free space wavelength
- wave impedance is never less than the free space impedance



- c. TEM mode is possible if the dimensions of the waveguide are properly chosen
- d. Propagation constant is always a real quantity

63. Consider the following statements with reference to Brewster angle:

1. For oblique incidence at a boundary, there is no reflected wave is vertically polarized.
2. Brewster angle can occur only at the boundary of a perfect conductor.
3. For a horizontally polarized wave, there is Brewster angle.
4. When the incident wave is not fully vertically polarized, there will be a reflected component which is horizontally polarized.

Which of these statements are correct?

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

64.



The circulation of  $H$  around the closed contour  $C$ , shown in the figure is :

- a. 0
- b.  $2I$
- c.  $4I$
- d.  $6I$

65. Match List I (Functions in the time domain) with List II (Fourier transform of the function) and select the correct answer:

List I

- A. Delta function
- B. Gate function
- C. Normalized Gaussian function
- D. Sinusoidal function

List II

1. Delta function
2. Gaussian function

3. Constant function

4. Sampling function

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

66. The poles of an analog system are related to the corresponding poles of the digital system by the relation  $Z = e^{sT}$ . Consider the following statements:

1. Analog system poles in the left half plane map onto digital system poles inside the circle  $|Z| = 1$
2. Analog system zeros in the left half of S-plane map onto digital system zeros inside the circle  $|Z| = 1$
3. Analog system poles on the imaginary axis of S-plane map onto digital system poles on the unit circle  $|Z| = 1$
4. Analog system zeros on the imaginary axis of S-plane map onto digital system zeros on the unit circle  $|Z| = 1$

Which of these statements are correct?

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

67. A transmission line of characteristic impedance  $400 \Omega$  is to be matched to a load of  $25 \Omega$  through a quarter wavelength line. The quarter wave line characteristic impedance must be

- a.  $40 \Omega$
- b.  $100 \Omega$
- c.  $400 \Omega$
- d.  $425 \Omega$

68. If the  $\vec{E}$  field of a plane polarized e.m. wave travelling in the  $Z$ -direction is :

$\vec{E} = \vec{a}_x E_x + \vec{a}_y E_y$ , then its  $\vec{H}$  field is

- a.  $\vec{a}_y \frac{E_x}{Z_0} - \vec{a}_x \frac{E_y}{Z_0}$
- b.  $\vec{a}_y \frac{E_x}{Z_0} + \vec{a}_x \frac{E_y}{Z_0}$
- c.  $\vec{a}_x \frac{E_y}{Z_0} - \vec{a}_y \frac{E_x}{Z_0}$

d.  $-\vec{a}_x \frac{E_y}{Z_0} - \vec{a}_y \frac{E_x}{Z_0}$

69. A dipole produces an electric field intensity of 1 mv/m at a distance of 2 km. The field intensity at a distance of 4 km will be

a. 1 mv/m  
b. 0.75 mv/m  
c. 0.50 mv/m  
d. 0.25 mv/m

70. Following antenna is frequently used for local area transmission at UHF/VHF

a. Ground monopole  
b. Turnstile antenna  
c. Slot antenna  
d. Loop antenna

71. Consider the following statements :

For electromagnetic waves propagating in free space :

1. electrical field is perpendicular to direction of propagation
2. electrical field is along the direction of propagation
3. magnetic field is perpendicular to direction of propagation
4. magnetic field is along the direction of propagation

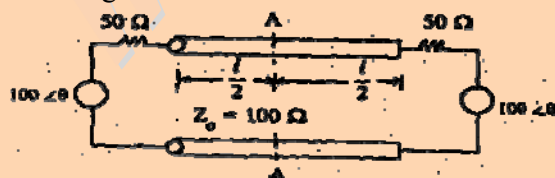
Which of these statements are correct?

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

72. When a particular mode is excited in a wave-guide, there appears an extra electric component in the direction of propagation. The resulting mode is

a. transverse - electric  
b. transverse -magnetic  
c. longitudinal  
d. transverse - electromagnetic

73. A lossless transmission line is connected to two identical voltage sources as shown in the figure.



The line impedance measured at the mid point AA of the

a.  $\infty$   
b. 100  
c. 50  
d. 25

74. The vector length of the curve  $\mu = \cos 2\theta$  (Cylindrical Co-ordinates) from  $\theta = 0$  to  $\theta = \pi$  is

a. 0.5  
b. 1.0  
c. 2.0  
d.  $\pi$

75. The most suitable primary standard for frequency is

a. Rubidium vapour standard  
b. Quartz standard  
c. Hydrogen maser standard  
d. Caesium beam standard

76. Horizontally mounted moving iron instruments employ

a. Eddy current damping  
b. Air friction damping  
c. Fluid friction damping  
d. Electromagnetic damping

77. There are four types of controlled sources, namely VC VS, VC CS, CC CS, and CC VS. It is required to select a proper controlled source configuration for interfacing the output of a high-impedance microphone to a low impedance loudspeaker. The proper source will be

a. VC VS (Voltage Controlled Voltage Source)  
b. VC CS (Voltage Controlled Current Source)  
c. CC CS (Current Controlled Current Source)  
d. CC VS (Current Controlled Voltage Source)

78. Some of the functional building blocks of a measurement system are :

Primary Sensing Element (PSE)  
Variable Conversion Element (VCE),  
or Transducer  
Data Transmission Element (DTE)  
Variable Manipulation Element (VME)  
Data Presentation Element (DPE)

The correct sequential connection of the functional building blocks for an electronic pressure gauge will be

- PSE, VME, VCE DPE, DTE
- PSE, VCE, VME, DTE, DPE
- DTE, DPE, VCE, PSE VME
- PSE, VCE, DTE, DPE, VME

79. According to Gaussian statistical analysis, if the confidence level is 0.80, then the values lying outside the confidence interval are

- 1 in 5
- 1 in 10
- 1 in 20
- 8 in 10

80. The true r. m .s. voltmeter employs two thermocouples in order to

- prevent drift
- increase the accuracy
- increase the sensitivity
- cancel out the nonlinear effects of first thermocouple

81. When BCC iron is heated, it changes to FCC iron resulting in

- contraction in volume
- increase in volume
- no change in volume
- crack in the material

82. When copper is added to silver in small quantity so as to form an alloy, the resistivity of such an alloy is

- equal to the resistivity of copper
- equal to the resistivity of silver
- greater than the resistivity of copper
- in between the resistivities of silver and copper

83. Match list I with list II and select the correct answer :

List I (Materials)

- Aluminium
- Phosphor Bronze
- Carbon
- Nichrome

List II (Applications of materials)

- Current carrying spring
- Heating element
- Commutator brush
- Telephone cords and trolley wires

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

84. When a semiconductor bar is heated at one end, a voltage across the bar is developed. If the heated end is positive, the semiconductor is

- p-type
- n-type
- intrinsic
- highly degenerate

85. The conductivity of a semiconductor crystal due to any current carrier is NOT proportional to

- mobility of the carrier
- effective density of states in the conduction band
- electronic charge
- surface states in the semiconductor

86. Amplification of ultrasonic waves is possible in a piezoelectric semiconductor under applied electric field. The basic phenomenon involved is known as

- Electrostriction
- Acousto-optic interaction
- Acousto-electric interaction
- Stimulate Brillouin scattering

87. Piezoelectric quartz crystal resonators find application where

- signal amplification is required
- rectification of the signal is required
- signal frequency control is required
- modulation of signal is required

88. When certain percentage of silicon is added to iron, the resistivity of the iron increases by a factor of 5. If a transformer core is made out of this iron, as compared to the previous value when silicon wave not added, the eddy current loss will be

- 77%
- 80%
- 83%
- 86%

89. Which of the following are the properties of ferromagnetic domains?

- Permanent magnetisation

2. Atomic moments in individual domains are all aligned neither parallel to nor perpendicular to one another below Curie point temperature
3. Each domain is magnetically saturated
4. Above Curie temperature, domains disrupt

Select the correct answer using the codes given below

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

90. Match list I with list II and select the correct answer:

List I (Insulators)

- A. Bakelite
- B. Window glass
- C. Pure silica
- D. Mica

List II (Resistivity)

1.  $10^5$  ohm-cm
2.  $10^9$  ohm-cm
3.  $10^{13}$  ohm-cm
4.  $10^{17}$  ohm-cm

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

91. Which of the following phenomena is most important when foodstuff is cooked in a microwave oven?

- a. Resistive Joule heating
- b. Induction heating
- c. Dielectric heating
- d. Radiation heating

92. The frequency dependence of electronic polarizability of a dielectric is obtained by solving the equation :

$$m\ddot{x} = -ax - 2b\dot{x} - 2E_0 \cos \omega t$$

Consider the following statements :

In this equation,

1. a is the restoring force constant, the expression for which is obtained from Coulomb's law
2. m is the combined mass of electrons and nucleus

3. b is the damping constant occurring due to emission of electromagnetic radiation

4.  $m\ddot{x}$  terms arises due to altered velocity of electrons orbiting the nucleus in presence of field.

Which of the above statements are correct?

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

93. The correct sequence of the following in the increasing order of the values of permittivity is

- a. Air, Vacuum,  $\text{TaO}_2$ , Glass
- b. Air, Vacuum, Glass,  $\text{TaO}_2$
- c. Vacuum, Air,  $\text{TaO}_2$ , Glass
- d. Vacuum, Air, Glass,  $\text{TaO}_2$

94. Match List I (Polarization process) with List II (Approximate frequency) and select the correct answer :

- A. List I
- B. Electronic polarization
- C. Ionic polarization
- D. Orientation polarization
- E. Space-charge polarization

List II

1.  $10^2$  Hz
2.  $10^5$  Hz
3.  $10^{13}$  Hz
4.  $10^{15}$  Hz

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

95. Which material among the following possesses excellent dielectric properties and good reliability for use in making capacitors?

- a. Silicon monoxide
- b. Silicon dioxide
- c. Tin oxide
- d. Chromium oxide

96. The most suitable material for making an LDR (light dependent resistor) is a semiconductor material having

- a.  $E_s \gg h\nu$

- b.  $E > h\nu$   
 c.  $E_S = h\nu$   
 d.  $E_S < h\nu$
97. Which one of the following is an essential component of electromechanical relays?  
 a. Graphite rod  
 b. LED  
 c. An electromagnet  
 d. MOSFET
98. In a degenerate semiconductor, the majority carriers are controlled by  
 a. Fermi-Dirac statistics  
 b. Maxwell-Boltzmann statistics  
 c. Bose-Einstein (B-E) statistics  
 d. Pauli's exclusion principle
99. Fermions are the particles, which obey:  
 a. Maxwell-Boltzmann's statistics  
 b. Bose-Einstein's statistics  
 c. Heisenberg's uncertainty principle  
 d. Pauli's exclusion principle
100. Excess carriers are generated in a sample of N-type semiconductor by shining light at one end. The current flow in the sample will be made up of  
 a. diffusion flow of carriers  
 b. drift flow of carriers  
 c. both diffusion and drift flow of carriers  
 d. neither diffusion nor drift flow of carriers
101. Consider two samples of silicon semiconductors identical in all respects except that one is uniformly doped with  $10^{15} \text{ cm}^{-3}$  donor impurity atoms (sample A) and the other is non-uniformly doped with donors from one side such that  $N_d(x) = N_0 e^{-ax}$  (sample B). Let  $a = 1 \text{ (hm)}^{-1}$  and  $N_0 = 10^{17} \text{ cm}^{-3}$ . Consider the following statements:  
 1. Sample A will not have any current at equilibrium but current will flow out of sample B  
 2. Both samples will have built-in electric field  
 3. Sample A will have zero built-in electric field whereas sample B will have a constant built-in electric field  
 4. No current will flow at equilibrium from either sample A or sample B  
 Which of the above statements are correct?  
 a. 1 and 2
- b. 1 and 3  
 c. 1 and 4  
 d. 3 and 4
102. Consider the following statements:  
 The temperature dependence of resistivity of a sample of N-type silicon is based upon carrier concentration and carrier mobility variations with temperature because  
 1. the resistivity of silicon increases with temperature.  
 2. the mobility decreases with temperature.  
 3. the carrier concentration increases with temperature.  
 4. the resistivity of silicon decreases with temperature.  
 Which of these statements are correct?  
 a. 1, 2 and 3  
 b. 2, 3 and 4  
 c. 1 and 2  
 d. 3 and 4
103. The unit of mobility is  
 a.  $\text{m}^2 \text{V}^{-1} \text{s}^{-1}$   
 b.  $\text{mV}^{-1} \text{s}^{-1}$   
 c.  $\text{Vsm}^{-1}$   
 d.  $\text{Vms}^{-1}$
104. The Haynes-Shockley experiment enables one to determine the  
 a. diffusion coefficient of majority carriers  
 b. effective mass of the minority carriers  
 c. mobility of the minority carriers  
 d. lifetime of the majority carriers
105. The Hall constant in a p-Si bar is given by  $5 \times 10^3 \text{ cm}^3/\text{Coulomb}$ . The hole concentration in the bar is given by  
 a.  $1.00 \times 10^{15}/\text{cm}^3$   
 b.  $1.25 \times 10^{15}/\text{cm}^3$   
 c.  $1.50 \times 10^{15}/\text{cm}^2$   
 d.  $1.6 \times 10^{15}/\text{cm}^3$
106. In an extrinsic semiconductor, the Hall coefficient  $R_H$   
 a. increases with increase of temperature  
 b. decreases with increase of temperature  
 c. is independent of the change of temperature  
 d. changes with the change of magnetic field



107. Consider a semiconductor bar having square cross-section. Assume that holes drift in the positive x-direction and a magnetic field is applied perpendicular to the direction in which holes drift. The sample will show

- a negative resistance in positive y-direction
- a positive voltage in positive y-direction
- a negative voltage in positive y-direction
- a magnetic field in positive y-direction

108. Match List I with List II and select the correct answer :

List I (Diode type)

- Zener Diode
- Gunn Diode
- Schottky
- Diode
- Tunnel Diode

List H (Important properties)

- Negative resistance device fabricated using semiconductors like Si, Ga, As, Ge etc. can be operated at a frequency of 10 GHz
- Quantum mechanical tunnelling with very thin depletion layers under reverse bias operated as a reference voltage sources
- Negative conductance device, operates on the principle of transfer of electron from one region of conduction band to another
- Metal-semiconductor diode, have rectification properties

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

109. Match list I with list II and select the correct answer:

List I

- Gunn Diode
- Solar Cell
- MOSFET
- SCR

List II

- Junction less device

- Single junction device
- Double junction device
- Triple junction device

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

110. The change in barrier potential of a silicon p-n junction with temperature is

- 0.025 Volts per degree C
- 0.250 Volts per degree C
- 0.030 Volts per degree C
- 0.014 Volts per degree C

111. Match List I (State of operation of an N-MOSFET) with List II (Required condition) and select the correct answer :

List I

- OFF
- Linear region
- Non-linear region
- Saturation region

List II

- $V_{gs} > V_{th}$ , and  $V_{ds} < (V_{gs} - V_{th})$
- $V_{gs} > V_{th}$ , and  $V_{ds} > (V_{gs} - V_{th})$
- $V_{gs} > V_{th}$
- $V_{gs} < V_{th}$

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

112. Match List I with List II and select the correct answer :

List I(SCR Rating)

- di/dt limit
- dv/dt limit
- $i^2t$  limit
- Junction temperature limit

List II(Potective element)

- Snubber
- Heat sink
- Series reactor
- Fuse

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

- d. 1 3 2 4
113. Match List I with list II and select answer the correct :

List I

- A. Super buffers  
B. Drivers  
C. Logic gates  
D. High speed operation

List II

1. Bi - C MOS technology  
2. C - MOS technology  
3. n-MOS technology  
4. ECL technology

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

114. Moor's law relates to
- speed of operation, of bipolar devices
  - speed of operation of MOS devices
  - power rating of MOS devices
  - level of integration of MOS devices
115. The range of values of a and b for which the linear time invariant system with impulse response

$$h(n) = a^n, n \geq 0$$

$$b^n, n < 0$$

will be stable is

- $|a| > 1, |b| > 1$
- $|a| < 1, |b| < 1$
- $|a| < 1, |b| > 1$
- $|a| > 1, |b| < 1$

116. Which one of the systems described by the following input-output relations is time invariant?

- $y(n) = n x(n)$
- $y(n) = x(n) - x(n-1)$
- $y(n) = x(-n)$
- $y(n) = x(n) \cos 2\pi f_0 n$

117. Match List I (Input-output relation) with list II (Property of the system) and select the correct answer :

List I

- A.  $y(n) = x(n)$   
B.  $y(n) = x(n^2)$   
C.  $y(n) = x^2(-n)$   
D.  $y(n) = x^2(n)$

List II

- Nonlinear, non - causal
- Linear, non-causal
- Linear, causal
- Nonlinear, causal

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

118. Consider the following statements related to Fourier series of a periodic waveform :

- It expresses the given periodic waveform as a combination of d.c. component, sine and cosine waveforms of different harmonic frequencies.
- The amplitude of spectrum is discrete.
- The evaluation of Fourier coefficients gets simplified if waveform symmetries are used.
- The amplitude spectrum is continuous.

Which of the above statements are correct?

- 1, 2 and 4
- 2, 3 and 4
- 1, 3 and 4
- 1, 2 and 3

119. The Fourier transform  $X(f)$  of the periodic delta functions,

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT) \text{ is :}$$

- $T \sum_{k=-\infty}^{\infty} \delta(f - kT)$
- $T \sum_{k=-\infty}^{\infty} \delta\left(f - \frac{k}{T}\right)$
- $\frac{1}{T} \sum_{k=-\infty}^{\infty} \delta\left(f - \frac{k}{T}\right)$
- $\frac{1}{T} \sum_{k=-\infty}^{\infty} \delta(f - kT)$

120. The color T.V. picture signal is a

- single - channel, one - dimensional signal
- single - channel, three -dimensional signal
- three - channel, one -dimensional signal
- three - channel, three - dimensional signal