ELECTRONICS AND TELECOMMUNICATION ENGINEERING

PAPER-I

1. If the energy gap of semiconductor is 1.1 eV, then it would be
   a. Opaque to the visible light
   b. Transparent to the visible light
   c. Transparent to the ultraviolet radiation
   d. Opaque to the infrared radiation

2. The skin depth of copper is found to be 66 μm at 1 MHz at a certain temperature. At the same temperature and at 2 MHz, the skin depth would be approximately
   a. 47 μm
   b. 33 μm
   c. 92 μm
   d. 122 μm

3. With increasing temperature, the electrical conductivity would
   a. Increase in metals as well as in intrinsic semiconductors
   b. Increase in metals but decrease in intrinsic semiconductors
   c. Decrease in metals but increase in intrinsic semiconductors
   d. Decrease in metals as well as in intrinsic semiconductors

4. Which one of the following statements is correct?
   a. All electrostrictive materials are piezoelectric, and all piezoelectric materials are electrostrictive
   b. Piezoelectric materials are a subset of electrostrictive materials
   c. Electrostrictive materials are a subset of piezoelectric materials
   d. Piezoelectricity and electrostriction are two totally independent properties of materials

5. Ferrites have
   a. Low copper loss
   b. Low eddy current loss
   c. Low resistively
   d. Higher specific gravity compared to iron

6. As per Curie-Weiss law, the magnetic susceptibility of a material varies as
   a. T^{-2}
   b. $1/T$
   c. T
   d. T^{2}

7. When subjected to alternating electrical stresses, an insulating material may be characterized by a complex dielectric constant $\epsilon_r' - j\epsilon_r''$. The dielectric losses in such materials when subjected to alternating electric stress will be proportional to
   a. ϵ_r''
   b. $\left(\epsilon_r'^{-2} + \epsilon_r''^{-2}\right)^{1/2}$
   c. $\epsilon_r''^{-2}$
   d. $\epsilon r'^{-2} + \epsilon r''^{-2}$

8. Yttrium-iron garnet (Y_2 Fe_5 O_{12}) is a soft magnetic material suitable for use in applications involving
   a. Direct current
   b. Ac of 50 to 60 Hz
   c. Ac of a few kHz
   d. Ac of a few hundred MHz

9. An air-cored inductance is a
   a. Linear circuit element because its reactance varies linearly with frequency
   b. Linear circuit element because its current varies linearly with voltage at a fixed frequency
   c. Non-linear circuit element in view of the possible magnetic saturation of the air core
   d. Non-linear circuit element in view of the equation v = l (di/dt) involving differentiation

10. Consider the following statements:

In the case of a superconductor,

1. The magnetic flux density is zero.
2. The relative permeability is high.
3. Diamagnetism is large.
4. Transition temperature varies with isotopic mass.

Of these statements

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

11. The resistance of a metallic wire would

a. Increase as the operating frequency increases
b. Decrease as the operating frequency increases
c. Remain unaffected on increasing the operating frequency
d. Initially increase up to a certain value of the operating frequency and then decrease with increase in operating frequency

12. Of the various capacitances associated with a junction transistor, the gain-band width product is affected to a maximum extent by

a. Base-collector parasitic capacitance
b. Base-collector space charge layer capacitance
c. Base-emitter space charge layer capacitance
d. Base-emitter diffusion capacitance

13. The modulation of effective base width by collector voltage is known as Early Effect.

Hence reverse collector voltage

a. Increases both alpha and beta
b. Decrease both alpha and beta
c. Increases alpha but decreases beta
d. Decreases beta but increases alpha

14. The ON voltage and forward break over voltage of an SCR depend on the

a. Gate current alone
b. Band gap of the semiconductor alone
c. Gate current and the semiconductor band gap respectively
d. Semiconductor band gap and the gate current respectively

15. An N-channel JFET has I_{DS} whose value is

a. Maximum for $V_{GS} = 0$, and maximum for V_{GS} = negative and large
b. Minimum for $V_{GS} = 0$, and maximum for V_{GS} = negative and large
c. Maximum for $V_{GS} = 0$, and minimum for V_{GS} = positive and large
d. Minimum for $V_{GS} = 0$, and maximum for V_{GS} = positive and large

16. Which of the following characteristics of a silicon p-n junction diode make it suitable for use as an ideal diode?

1. It has very low saturation current.
2. It has a high value of forward cut-in voltage
3. It can withstand large reverse voltage.
4. When compared with germanium diodes, silicon diodes show a lower degree of temperature dependence under reverse bise conditions.

Select the correct answer using the codes given below:

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

17. An incremental model of a solid state deceive is one which represents the

a. A property of the device at the desired operating point
b. Dc property of the device at all operating points
c. Complete ac and dc behavior of the device at all operating points
d. Ac property of the device at all operating points

18. For a bipolar junction transistor, if the current amplification factor and cut-off-frequency in the CB mode are α_{ac} and $f_{\alpha CB}$ respectively, then the cut-off frequency in the CE mode is equal to

a. $f_{\alpha CB} / \alpha_{ac}$
b. $f_{\alpha CB}(1-\alpha_{ac})$
c. $f_{\alpha CB} / (1-\alpha_{ac})$
d. $\alpha_{CB} \cdot f_{\alpha CB}$

19. Consider the following statements:

The threshold voltage of a MOSFET can be lowered by

1. Using a thinner gate oxide.
2. Reducing the substrate concentration.
3. Increasing the substrate concentration.

a. 3 alone is correct
b. 1 and 2 are correct
c. 1 and 3 are correct
d. 2 alone is correct

20. Which one of the following statements regarding the two-transistor model of the p-n-p-n four layer device is correct?

a. It explains only the turn ON portion of the device characteristic
b. It explains only the turn OFF portion of the device characteristic
c. It explains only the negative region portion of the device characteristic
d. It explains all the regions of the device characteristics

21. Consider the following steps:

1. Etching
2. Exposure to uv radiation
3. Stripping
4. Developing.

After a wafer has been coated with photo resist, the correct sequence of these steps in photolithography is:

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

22. Consider the following statements:

When compared to metal wires, optical fibers

1. Have large bandwidth.
2. Are more immune to electromagnetic interference.
3. Are better suited for operation at high power level.

Of these statement

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

23. The Thevenin equivalent of the network shown in Fig. I is 10 V in series with a resistance of 2Ω. If now, a resistance of 3Ω is connected across AB as shown in Fig. II, the Thevenin equivalent of the modified network across AB will be

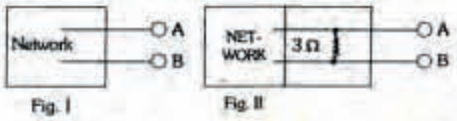


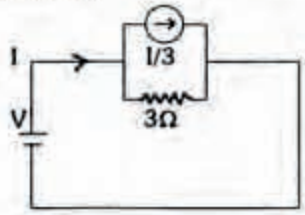
Fig. I Fig. II

a. 10 V in series with 1.2Ω resistance
b. 6 V in series with 1.2Ω resistance
c. 10 V in series with 5Ω resistance
d. 6 V in series with 5Ω resistance

24. A certain network consists of two ideal voltage sources and a large number of ideal resistors. The power consumed in one of the resistors is 4W when either of the two sources is active and the other is replaced by a short circuit .The power consumed by the same resistor when both the sources are simultaneously active would be

a. Zero or 16 W
b. 4 W or 8 W
c. Zero or 8 W
d. 8 W or 16 W

25. In the circuit shown in the figure, the effective resistance faced by the voltage source is



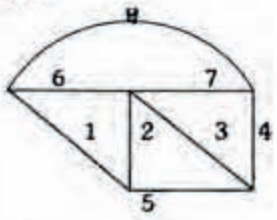
a. 1Ω
b. 2Ω
c. 3Ω
d. 3.3Ω

26. The graph of a network has six branches with three tree branches. The MINIMUM number of equation required for the solution of the network is

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

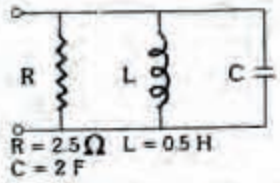
27. In the graph shown in the figure, one possible tree is formed by the branches

4,5,6,7. Then one possible fundamental cut set is



a. 1,2,3,8
b. 1,2,5,6
c. 1,2,6,8
d. 1,2,3,7,8

28. The circuit shown in the figure is to be scaled to an impedance level of 5kΩ and a resonant frequency of 5M rad/s. Which one .of the following is a correct set of element values for the scaled circuit?



a. $2.5\Omega, 0.2\ mH, 200\ pF$
b. $5k\Omega, 0.2\ mH, 200\ \mu F$
c. $5k\Omega, 0.2\ mH, 200\ \mu F$
d. $5k\Omega, 0.1\ mH, 0.4\ \mu F$

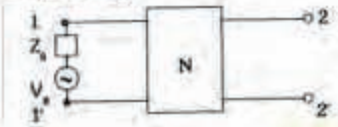
29. In a parallel RLC circuit, if L = 4H, C = 0.25 F and R = 40Ω, then the value of Q at resonance will be

a. 1
b. 10
c. 20
d. 40

30. A series RLC circuit is excited by an ac voltage v(t) = 1 sin t. It L = 10H and C = 0.1 F, then the peak value of the voltage across R will be

a. 0.707
b. 1
c. 1.414
d. Indeterminate as the value R is not given

31. Two two-port network shown in the figure is characterized by the impedance parameters Z_{11}, Z_{12}, Z_{21} and Z_{22}, for the equivalent Thevenin's source looking to the left of port 2, the V_T and Z_T will be respectively



a. $V_T = \frac{Z_{11}}{Z_{11}+Z_g}V_g; Z_T = Z_{22} - Z_{12}$

b. $V_T = \frac{Z_{12}}{Z_{11}+Z_g}V_g; Z_T = Z_{22} - Z_{12}$

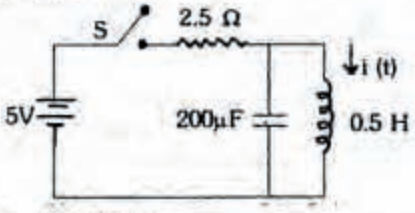
c. $V_T = \frac{Z_{21}V_g}{Z_{11}+Z_g}; Z_T = Z_{22} - \frac{Z_{12}Z_{21}}{Z_{11}+Z_g}$

d. $V_T = \frac{Z_{12}V_g}{Z_{11}+Z_g}; Z_T = Z_{22} - \frac{Z_{12}Z_{21}}{Z_{11}+Z_g}$

32. Frequency response of the function $T(s) = (s+1)/(s+2)$ exhibits a maximum phase at a frequency (in radian/sec)

a. 0
b. $\frac{1}{\sqrt{2}}$
c. $\sqrt{2}$
d. ∞

33. In the network shown in the figure, the switch 'S' is closed and a steady state is attained. If the switch is opened at t = 0, then the current i (t) through the inductor will be



a. Cos 50 t A
b. 2A
c. 2 cos 100 t A
d. 2 sin 50 t A

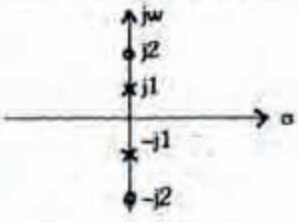
34. A series RL circuit initially relaxed. A step voltage is applied to the circuit. If τ is the time constant of the circuit, the voltage across R and L will be the same at time t equal to

a. $\tau \log_e 2$
b. $\tau \log_e \frac{1}{2}$

c. $\frac{1}{\tau}\log_e 2$

d. $\frac{1}{\tau}\log_e \frac{1}{2}$

35. The pole-zero pattern of a particular filter is shown in the figure. It is that of a/an



a. Low-pass filter
b. High-pass filter
c. Band-pass filter
d. All-pass filter

36. A resistance coil possesses residual self-inductance and capacitance apart from its resistance. Taking into consideration all three, the impedance across the coil is given by

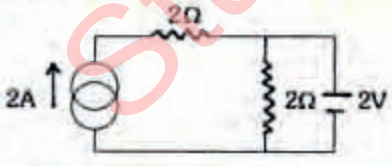
a. $\frac{R}{(sL+R)sC+1}$

b. $\frac{(R+sL)}{sC(R+sL)+1}$

c. $\frac{R}{sL(R+sC)}$

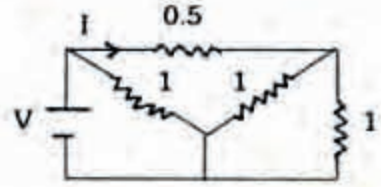
d. $\frac{sC}{(R+sL)sC+1}$

37. The total power consumed in the circuit shown in the figure is



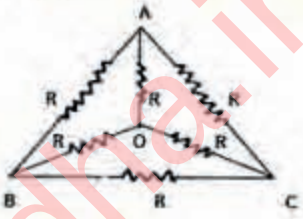
a. 10 V
b. 12 V
c. 16 V
d. 20 V

38. In the circuit shown in the figure, If I = 2, then the value of the battery voltage V will be



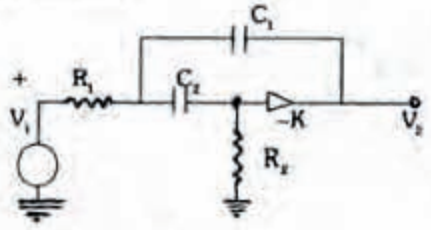
a. 5 V
b. 3 V
c. 2 V
d. 1 V

39. The effective resistance between the terminals A and B in the circuit shown in the figure is:



a. R
b. R -1
c. R/2
d. $\frac{6}{11}R$

40. The network shown in the figure represents a



a. Band-pass filter
b. Low-pass filter
c. High-pass filter
d. Band-stop filter

41. In active filter circuits, inductances are avoided mainly because they

a. Are always associated with some resistance
b. Are bulky and unsuitable for Miniaturization
c. Are non-linear in nature
d. Saturate quickly

42. The magnitude response of a normalized Butterworth low-pass filter is

a. Liner starting with the values of unity at zero frequency and 0.707 at. the cut-off frequency
b. Non-liner all through but with values of unity at zero frequency and 0.707 at the cut-off frequency
c. Linear up to the cut-off frequency and non-linear thereafter
d. Non-linear up to the cut-off frequency and linear thereafter

43. The driving-point impedance function of a reactive network is:

$$Z(s)=\frac{(s^2+4)(s^2+16)}{s(s^2+9)}$$

Consider the following circuits in this regard:

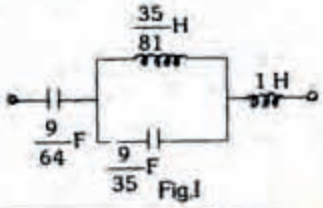


Fig.I

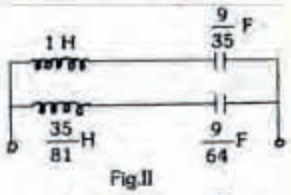


Fig.II

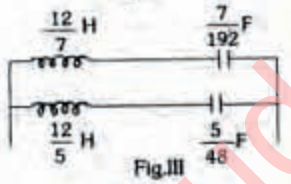


Fig.III

Fig.IV

The first second Foster forms will be as in figure

a. I and III respectively
b. II and IV respectively
c. I and II respectively
d. III and IV respectively

44. Which of the following pairs are correctly matched?

1. Brune's realization...Realization with ideal transformer.
2. Cauer realization....Ladder realization.
3. Bott-Duffin reali....Realization with non-ideal transformer.

Select the correct answer using the codes given below:

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

45. The polynomial

$P(s)=(s-1)(s^2+1)(s+2)(s+3)$ is

a. Hurwitz, but not strict Hurwitz
b. Not Hurwitz
c. Strict Hurwitz
d. Anti-Hurwitz

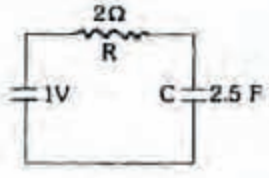
46. The poles and zeros of a driving-point function of a network are simple and interlace on the negative real axis with a pole closest to the origin. It can be realized

a. By an LC network
b. As an RC driving-point impedance
c. As an RC driving-point admittance
d. Only by an RLC network

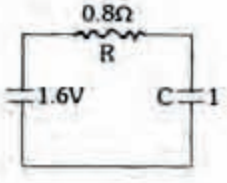
47. Which of the following circuits would be valid for a simple circuit consisting of R and C and whose state equation is given by

$$\frac{dV_c}{dt}=2-1.25V_c(t)$$

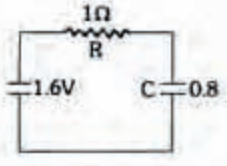
1.



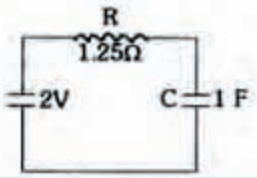
2.



3.



4.



Select the correct answer using the codes given below:

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

48. Which one of the following state-space models is the correct representation of the physical system described by the differential equation

$$\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}+6y(t)=8u(t)\ ?$$

a.
$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}0 & 1\\ -6 & -4\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 8\end{bmatrix}u(t)$$
$$y(t)=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$$

b.
$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}1 & 0\\ -6 & -4\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 8\end{bmatrix}u(t)$$
$$y(t)=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$$

c.
$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}0 & 1\\ -6 & -4\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 8\end{bmatrix}u(t)$$
$$y(t)=\begin{bmatrix}0 & 1\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$$

d.
$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}0 & 1\\ -4 & -6\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}0\\ 8\end{bmatrix}u(t)$$
$$y(t)=\begin{bmatrix}1 & 0\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$$

49. The system described by the difference equation
$y(n)-2y(n-1)+y(n-2)=x(n)-x(n-1)$
has $y(n)=0$ and $n<0$. If $x(n)=\delta(n)$ then $y(2)$ will be

a. 2
b. 1
c. Zero
d. –1

50. Which of the following represent a stable system?

1. Impulse response of the system decreases exponentially.
2. Area within the impulse response is finite.
3. Eigen values of the system are positive and real.
4. Roots of the characteristic equation of the system are real and negative.

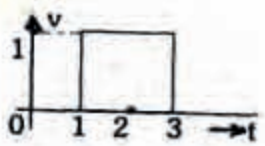
Select the correct answer using the codes given below:

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

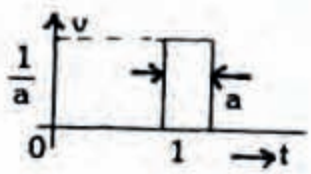
51. Match list-I with list-II and select the correct answer using the codes given below the Lists:

List I

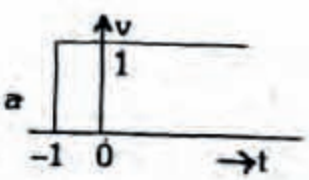
A.



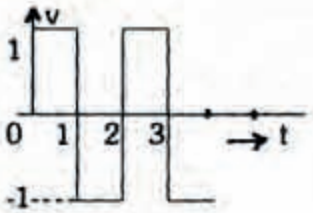
B.



C.



D.



List II

1. $v(t)=u(t+1)$
2. $v(t)=u(t)-2u(t-1)+$

   $2u(t-2)-2u(t-3)+...$
3. $v(t)=u(t-1)-u(t-3)$
4. $a\to 0 v(t)=\delta(t-1)$

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

52. Match' List-I (Source of signal) with List-II (Type of signal) and select the correct answer using the codes given below the Lists:

List I

A. Output of a signal generator

B. Error signal from a synchro

C. Output of a J-K flip-flap

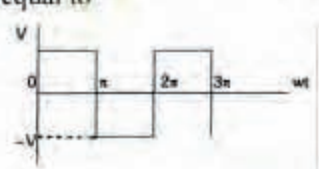
D. Signal received by radar

List II

1. Modulated
2. Digital
3. Analog
4. Stochastic

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

53. The amplitude of the first odd harmonic of the square wave shown in the figure is equal to



a. $\frac{4V}{\pi}$

b. $\frac{2V}{3\pi}$

c. $\frac{V}{\pi}$

d. 0

54. A periodic triangular wave is shown in the figure. Its Fourier components will consist only of

a. All cosine terms

b. All sine terms

c. Odd cosine terms

d. Odd sine terms

55. Which one of the following is. the correct Fourier transform of the unit step signal

$$u(t)=\begin{cases}1 & for\ t\geq 0\\ 0 & for\ t<0\end{cases}$$

a. $\pi\delta(w)$

b. $\frac{1}{jw}$

c. $\frac{1}{jw}+\pi\delta(w)$

d. $\frac{1}{jw}+2\pi\delta(w)$

56. The Fourier transform of $v(t)=\cos w_0 t$ is given by

a. $V(t)=\frac{1}{2}\delta(f-f_0)$

b. $V(f)=\frac{1}{2}\delta(f+f_0)$

c. $V(f)=\frac{1}{2}[\delta(f-f_0)-\delta(f+f_0)]$

d. $V(f)=\frac{1}{2}[\delta(f-f_0)+\delta(f+f_0)]$

57. If $g\leftrightarrow(t)\ G\ (f)$ represents a Fourier transform pair, then according to the duality property of Fourier transforms

a. $G(t) \rightleftharpoons g(f)$

b. $G(t) \rightleftharpoons g^*(f)$

c. $G(t) \rightleftharpoons g(-f)$

d. $G(t) \rightleftharpoons g^*(-f)$

58. If x (f) and its first derivative are Laplace transformable and the Laplace transform of X (t) is X(s), then $\lim_{t \to 0} x(f)$ is given by

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

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

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

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

59. If $\delta(t)$ denotes a unit impulse, then the Laplace transform of $\frac{d^2\delta(t)}{dt^2}$ will be

a. 1

b. s^2

c. S

d. s^{-2}

60. The unit step response of a system is given by $\left(1-2^{-\alpha t}\right)u(t)$. It impulse responses is:

a. $e^{-\alpha t}u(t)$

b. $\alpha e^{-\alpha t}u(t)$

c. $\frac{1}{\alpha}e^{-\alpha t}u(t)$

d. $-\alpha e^{-\alpha t}u(t)$

61. Given that $h(t) = 10e^{-10t}u(t)$, and $e(t) = \sin 10\pi u(t)$. The Laplace transform of the signal $f(t) = \int_0^t h(t-\tau)e(\tau)d\tau$ is given by

a. $\frac{10}{(s+10)(s^2+100)}$

b. $\frac{10(s+10)}{(s^2+100)}$

c. $\frac{100}{(s+1)(s^2+100)}$

d. $\frac{1}{(s+10)(s^2+100)}$

62. Given that F(z) and G (z) are the one-sided Z transforms of discrete time functions f (nT) and g (nT), the transform of $\sum_{k=0}^{\infty} f(kT)g(nT-kT)$ is given by

a. $\sum_{n=0}^{\infty} f(nT)g(nT)z^{-n}$

b. $\sum_{n=0}^{\infty} f(nT)z^{-n}\sum_{n=0}^{\infty} g(nT)z^{-n}$

c. $\sum_{k=-\infty}^{\infty} f(kT)g(nT-kT)z^{-k}$

d. $\sum_{k=-\infty}^{\infty} f(nT-kT)g(nT)z^{-k}$

63. Match List I $(x[n])$ with List II $(x[z])$ and select the correct answer using the codes given below the lists:

List I

A. $a^n u[n]$

B. $a^{n-2}u[n-2]$

C. $a^m a^n$

D. $na^n u[n]$

List II

1. $\frac{az}{(z-a)^2}$

2. $\frac{ze^{-1}}{ze^{-1}-a}$

3. $\frac{z}{z-a}$

4. $\frac{Z^{-1}}{z-a}$

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

64. Which one of the following represents the impulse response of a system defined bt

$H(z) = z^{-m}$?

a. $u[n-m]$

b. $\delta[n-m]$

c. $\delta[m]$

d. $\delta[m-n]$

65. The autocorrelation function $R_x(\tau)$ satisfies which one of the following properties?

a. $R_x(\tau) = -R_x(-\tau)$

b. $R_x(\tau) = R_x(-\tau)$

c. $R_x(\tau) \geq R_x(0)$

d. $R_x(\tau) \geq 1$

66. The autocorrelation function $R_x(\tau)$ of the signal $X(t) = V \sin wt$ is given by

a. $1/2V^2 \cos w\tau$

b. $V^2 \cos w\tau$

c. $V^2 \cos^2 w\tau$

d. $2V^2 \cos^2 w\tau$

67. An infinite plane Z = 10 m carries a uniformly distributed charge of density 2n C/m^2. The electric field intensity at the origin is

a. $0.2\vec{a}_z nV/m$

b. $2\vec{a}_z nV/m$

c. $-2\vec{a}_z nV/m$

d. $-36\pi\vec{a}_z V/m$

68. An electric charge of 100 coulombs is enclosed in a sphere of radius 100 m. The electric displacement density (in coulomb/m^2) D is

a. 0.0833

b. 0.833

c. 1.666

d. 10

69. If an isolated conducting sphere in air has radius = $\frac{1}{4\pi \in_0}$ its capacitance will be

a. Zero

b. 1F

c. $4\pi F$

d. $\in_0 F$

70. Poisson's equation for an inhomogeneous medium is:

a. $\in \nabla^2 V = -\rho$

b. $\nabla \cdot (\in \nabla V) = -\rho$

c. $\nabla^2 (\in V) = -\rho$

d. $\nabla \cdot (\nabla \in V) = -\rho$

71. A 75 ohm transmission line is to be terminated in two resistive loads R_1 and R_2 such that the standing patterns in the two cases have the same SWR. To obtain the desired result, the values of R_1 and R_2 (in ohms) should be

a. 250 and 200 respectively

b. 225 and 25 respectively

c. 100 and 150 respectively

d. 50 and 125 respectively

72. The input impedance of a loss-less transmission line is '100 ohms when terminated in a short-circuit, and 64 ohms when terminated in an open circuit. The characteristic impedance of the line is

a. 80 Ω

b. 164 Ω

c. 36 Ω

d. 64 Ω

73. One end of a loss-less transmission line of length $\frac{3}{8}\lambda$ and characteristic impedance R_0 is short-circuited, and the other end is terminated in R_0. The impedance measured at $\frac{\lambda}{8}$ away from the end terminated in R_0 is:

a. Zero

b. R_0

c. $R_0/2$

d. Infinite

74. For a quarter wavelength ideal transmission line 01 characteristic impedance 50 ohms and load impedance 100 ohms, the input impedance will be

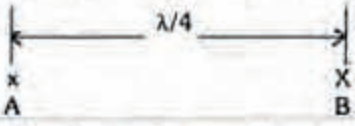
a. 25 Ω

b. 50 Ω

c. 100 Ω

d. 150Ω

75. For two identical antennas A and B spaced $\lambda/4$ apart as shown in the figure, it is possible to have null radiation along the array axis on the right side of B by having an excitation arrangement such that



a. The phase of current in antenna B lags behind that of antenna A by $\pi/2$ radians

b. Currents in the antennas are in phase

c. The phase of current in antenna A lags behind that of antenna B by it $\pi/2$ radians

d. Current in the antennas are out of phase by π it radians

76. Consider the following statements about the maximum usable frequency for radio communication between two specified points by reflection from an ionosphere layer:

1. It is equal to the critical frequency.
2. It is more than the critical frequency.
3. It depends upon the distance between the two points.
4. It depends upon the height of the ionosphere layer.

Of these statements

a. 1 and 4 are correct

b. 1, 3, and 4 are correct

c. 2 and 3 are correct

d. 2, 3 and 4 are correct

77. Which one of the following statements DOES NOT pertain to the equation $\nabla.\vec{B}=0$?

a. There are no sinks and sources for magnetic fields

b. Magnetic field is perpendicular to the electric field

c. Single magnetic pole, cannot exist

d. B is solenoidal

78. If a current elements of a yew small length and carrying a current $I_0 e^{j\omega t}$ radiates a total average power P_t into free space, then P_t will, be proportional to

a. I_0

b. I_0^2

c. I_0^3

d. $I_0^{1/2}$

79. Which one of the following sets of equations is independent in Maxwell's equations?

a. The two curl equations

b. The two divergence equations

c. Both the curl and divergence equations

d. The two curl equations combined with the continuity equation

80. The effective area of a transmitting antenna is one square meter, the effective area of the receiving antenna is 0.9 square meter and the wavelength is 0.03 m. If the distance between the transmitter and receiver is 100 m and the power transmitted is 100 W, then the power received will be

a. 1 W

b. 10 W

c. 30 W

d. 40 W

81. In order to radiate 100 W from a circular loop of circumference equal to 0.1λ, the current required will be

a. 10 A

b. 100 A

c. 200 A

d. 400 A

82. If u is the velocity of propagation in an unbounded medium, u_p, and u_g are the phase and group velocities in a guide filled with a medium, having the same permittivity as that of the unbounded medium, then u, u_p, and u_g are related as

a. $u_p u = u^2$

b. $u_g u = u^2$

c. $u_p u_g = u^2$

d. $(u-u_p)(u-u_g)=u^2$

83. In the case of a cubic cavity resonator, the degenerate modes would include

a. TM_{111}, TE_{011} and TE_{101}

b. TM_{011}, TE_{010} and TE_{111}

c. TM_{110}, TE_{012} and TE_{102}

d. TM_{110}, TE_{011} and TE_{101}

84. In a hollow rectangular waveguide, the phase velocity

a. Increases with increasing frequency

b. Decreases with increasing frequency

c. Is independent of frequency

d. Will vary with frequency depending upon the frequency range

85. A hollow cubic cavity resonator has a dominant resonant frequency of 10 GHz. The length of each side is

a. $\sqrt{3}cm$

b. $\frac{\sqrt{3}}{2}cm$

c. $\sqrt{2}\,cm$

d. $\frac{3}{\sqrt{2}}$

86. A dominant mode waveguide, not terminated in its characteristic impendence, is excited with a 10 GHz signal. If 'd' is the distance between two successive minima of the standing wave in the guide, then

a. D = 1.5 cm

b. D is less then 1.5 cm

c. D is greater than 1.5 cm

d. D = 3 cm

87. In a rectangular waveguide, with a = 2b, if the cut-off frequency for TE_{20} mode is 16 GHz, then the cut-off frequency for the TM_{11} mode will be

a. 32 GHz

b. 8 GHz

c. $4\sqrt{3}$ GHz

d. $8\sqrt{5}$ GHz

88. Evanescent mode attention in a waveguide depends upon the

a. Conductivity of the dielectric filling the waveguide

b. Operating frequency

c. Conductivity of the guide walls

d. Standing waves in the guide

89. A transmitter in free space radiates a mean power of 'P' Watts' uniformly in all directions At a distance 'd' sufficiently far from the source, in order that the radiated field is considered as plane, the electric field 'E' should be related to 'P' and 'd' as

a. $E\alpha Pd$

b. $E\alpha\frac{P}{d}$

c. $E\alpha\sqrt{Pd}$

d. $\alpha E\frac{\sqrt{P}}{d}$

90. If $\vec{H} = 0.2\cos(wt - \beta x)a_z$ A/m is the magnetic field of a wave in free space, then the average power passing through a circle of radius 5cm in the x = 1 plane will be approximately

a. 30 mW

b. 60 mW

c. 120 mW

d. 150 mW

91. An attenuator drops a 10 V signal to 50mV in an experiment. The loss in decibels is

a. – 40 dB

b. – 46 dB

c. – 55 dB

d. – 60 dB

92. A moving coil instrument has a resistance of 10 ohms and takes 40 mA to produce full-scale deflection. The shunt resistance required to convert this instrument for use as an ammeter of range 0 to 2 A is:

a. 0.1021 Ω

b. 0.2041 Ω

c. 0.2561 Ω

d. 0.4210 Ω

93. Which one of the following measuring instruments would consume the LOWEST power from the source during measurement?

a. Permanent magnet moving coil

b. Electronic millimeter

c. Electrostatic instrument

d. Moving iron instrument

94. The use of thermocouple meters for ac measurement leads to a meter scale which is

a. Linear
b. Square law
c. Logarithmic
d. Exponential

95. A dynamometer type of wattmeter is connected in an ac circuit. The power indicated by the wattmeter is the
a. rms power
b. Average power
c. Peak power
d. Instantaneous power

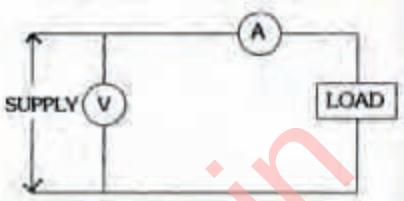
96. In terms of LMTQ system of dimensional parameters, the dimension of 'permittivity' can be expressed as
a. $L^{-3}M^{-1}T^{2}Q^{2}$
b. $L^{-1}M^{-1}T^{2}Q^{2}$
c. $L^{2}MT^{-1}Q^{-1}$
d. $L^{-2}M^{-1}T^{2}Q^{2}$

97. The D' Arsonval meter movement can be converted into an audio frequency ac ammeter by adding to it a
a. Thermocouple
b. Rectifier
c. Chopper
d. Transducer

98. With reference to 'random error' in measurement, the standard deviation σ can be expressed, in terms of deviation of any individual observation from the mean of the group 'd_m' and the number of observations in the group 'n' as
a. $\sigma = \frac{\sum dm}{n}$
b. $\sigma = \sqrt{\frac{\sum d^2 m}{n}}$
c. $\sigma = \frac{\sqrt{\sum d^2 m}}{n-1}$
d. $\sigma = 0{,}6745\sqrt{\frac{\sum d^2 m}{n-1}}$

99. The time base of a high frequency CRO whose screen diameter is 10 cm is set at 10 μ sec/cm. The lowest frequency of the signal that can be fully displayed on this CRO for measurement and analysis with great accuracy is
a. Greater than 100 kHz
b. Equal to 100kHz
c. Equal to 10 kHz
d. Less than 10 kHz

100. In the circuit shown in the figure, if the voltmeter and the ammeter are interchanged, it is likely to result in damage to



a. Both the instruments
b. The ammeter
c. The voltmeter
d. Neither of these instruments

101. A special voltmeter can be devised which can measure the amplitude of a signal at two points in a circuit and simultaneously measure the phase difference between the voltage waveform at these two points. Such a meter would be a
a. Phase meter
b. Waveform meter
c. Vector voltmeter
d. Digital voltmeter

102. An instrument needs an amplifier to amplify pulses of one microsecond duration. This amplifier must have a bandwidth of at least
a. 10 kHz
b. 10 MHz
c. 1 kHz
d. 1 MHz

103. A diode peak reading VTVM and a thermocouple meter are connected across the output of an amplitude modulator circuit. In the absence of modulation, both the meters read 10 V. When a sinusoidal AM is applied, the VTVM reads 15 V. The reading of the thermocouple meter in this case will be
a. 10 V
b. 12.5 V
c. 14.1 V
d. 15 V

104. The input impedance of a CRO is I M ohm in parallel with 10pF. If the CRO is required to display pulse using a 10:1 attenuator, the attenuator will have to use a
   a. 9 M ohm resistor
   b. 1.11 pF capacitor
   c. Parallel combination of 9 M ohm resistor and 1.11 pF capacitor
   d. Series combination of 9 M ohm resistor and 1.11 pF capacitor

105. The dynamic characteristics of capacitive transducers are similar to those of a
   a. Low-pass filter
   b. High-pass filter
   c. Notch filter
   d. Band-stop filter

106. Which one of the following detectors is generally used in ac bridges for audio frequency range?
   a. Ac voltmeter
   b. CRO
   c. Headphones
   d. Vibration galvanometer.

107. The most useful transducer for displacement sensing with excellent sensitivity linearity and resolution is
   a. An incremental encoder
   b. An absolute encoder
   c. A LVDT
   d. A strain gauge

108. A 24 mm long conductor has a resistance of 128 ohms if the change in resistance is 13.3 ohms and the change in length is 1.6 mm under tersion, the gauge factor of the conductor will be approximately
   a. 1.2
   b. 1.6
   c. 2.1
   d. 2.6

109. The temperature coefficient of resistance for a Hermiston is
   a. Low and negative
   b. Low and positive
   c. High and negative
   d. High and positive

110. A variable reluctance type tachometer has 150 teeth on the rotor. The counter records 13,500 pulses per second. The rotational speed is
   a. 4800 rpm
   b. 5400 rpm
   c. 6000 rpm
   d. 7200 rpm

111. A linear displacement transducer of the digital type generally used
   a. Straight binary code
   b. BCD
   c. Gray code
   d. Hexadecimal code

112. For measuring temperature below 20 K with high accuracy, the most useful instrument is
   a. An optical pyrometer
   b. A thermistor-based thermometer
   c. Ga As pn-junction diode thermometer
   d. Platinum resistance thermometer

113. If low pressure of the order of 10^{-6}mm of Hg is to be measured, the instrument of choice would be
   a. Compound pressure gauge
   b. Thermocouple vacuum gauge
   c. Pirani gauge
   d. Ionization type vacuum gauge

114. A digital displacement indicator based on a linear voltage differential transformer (LVDT) transducer and A/D conversion used a LVDT with a sensitivity of 1 m V/mm. If the smallest displacement to be measured is 0.1mm and the maximum displacement of the LVDT core is 10 cm, then the digital display required for the instrument has to be
   a. 2 digit type
   b. $2\frac{1}{2}$ digit type
   c. 3 digit type
   d. $3\frac{1}{2}$ digit type

115. **Assertion A:** FM/FM radio telemetry system is suitable in situations where the data consists of a small number of channels of low frequency range.

Reason R : The restriction in the number of channels is due to the fact that the data is continuously transmitted.

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

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

c. A is true but R is false

d. A is false but R is true

116. **Assertion A:** High power transistors are invariably made of silicon.

Reason R: Silicon is a direct band gap semiconductor.

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

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

c. A is true but R is false

d. A is false but R is true

117. **Assertion A:** If a semiconductor is placed in a transverse magnetic field B, and an electric field E is applied across its other two faces, then it would produce an electric current 'I' in the direction perpendicular to both B and E.

Reason R: Hall coefficient is proportional to the mobility of change carriers in the semiconductor.

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

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

c. A is true but R is false

d. A is false but R is true

118. **Assertion A:** Considering two p-n-p and n-p-n transistors of identical construction as far as shape, size and doping are concerned, the n-p-n transistor will have a better frequency response.

Reason R: The electron mobility is higher than that of the hole mobility.

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

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

c. A is true but R is false

d. A is false but R is true

119. **Assertion A:** For the same voltage source connected to the series connection of coils shown in Fig. I, the current indicated in the ammeter in Fig. II will be less.

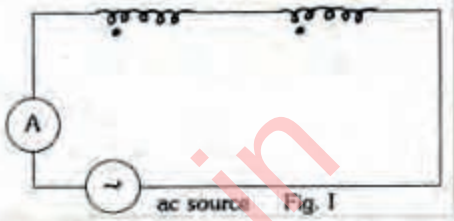


Fig. I

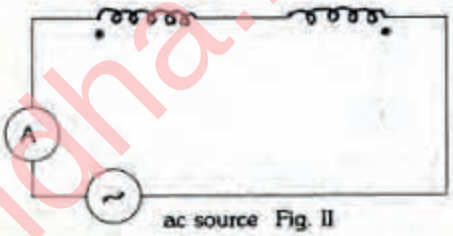


Fig. II

Reason R: When the coil connection is reversed, the mutual inductance direction is changed.

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

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

c. A is true but R is false

d. A is false but R is true

120. **Assertion A:** The total emf induced in a circuit is equal to the time rate .of change of the total magnetic flux linking the circuit.

Reason R: The induced current in a loop is always so directed as to produce a flux opposing the change in the flux density.

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

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

c. A is true but R is false

d. A is false but R is true