ELECTRICAL ENGINEERING

PAPER-I

1. Consider the following statements :
In electrostatics, the Equipotential surface is defined as the surface where
1. electric field intensity is normal everywhere.
2. electric field intensity is tangential everywhere.
3. no work is done in moving a charge over it.
4. no charge is present.

Of these statements
a. 1 alone is correct
b. 3 and 4 are correct
c. 1 and 3 are correct
d. 2 and 4 are correct

2. A capacitor is made up of two concentric spherical shells. The radii of the inner and outer shells are R_1 and R_2 respectively and $\in$ is the permittivity of the medium between the shells. The capacitance of the capacitor is given by

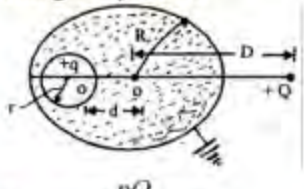
a. $\frac{1}{4\pi\in}\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

b. $\frac{1}{4\pi\in}\left(\frac{1}{R_1}+\frac{1}{R_2}\right)$

c. $4\pi\in\frac{R_1R_2}{R_1-R_2}$

d. $4\pi\in\frac{R_1R_2}{R_1-R_2}$

3. A charge + q is placed at the centre of a spherical cavity in a grounded conduting sphere as shown in the figure. Another charge +Q is placed outside on the line joining O and O'. The force acting on the charge + q will be



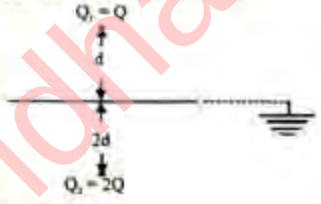
a. $\frac{pQ}{4\pi\in_0(D+d)}$

b. $\frac{pQ}{4\pi\in_0 D}$

c. zero

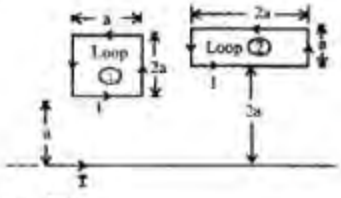
d. dependent on the charge density distribution on the conductor and will not have a closed-form expression.

4. Two point charges ($Q_1 = Q$, $Q_2 = 2Q$) and an infinite grounded plane are shown in the figure. The forces F_1 and F_2, on Q_1 and Q_2, will be in the ratio



a. 1 : 1
b. 1 : 2
c. 1 : 4
d. 1 : 8

5. Two rectangular loops and an infinite wire, all carrying current 'I' are shown in the given figure. If the force on loop 1 due to the infinite wire were 'F', then the force on loop 2 due to the infinite wire would be



a. F/3
b. F/2
c. F
d. $\frac{3}{2}$F

6. An infinite number of concentric circular loops carry a current 'I' each hut alternately in opposite directions. The radii of the loops are R, 2R, 4R……. in geometric progression. The magnetic flux density at the centre of the loops will be
a. Zero
b. $\frac{\mu_0 I}{3R}$

c. $\frac{\mu_0 I}{4R}$

d. $\frac{\mu_0 I}{6R}$

7. For a current element Idl. situated at an arbitrary point, the magnetic vector potential A equals (R is the distance, of the observation point from the centre of the current element)
   a. $\mu Idl / (4\pi R)$
   b. $\mu Idl / (4\pi R^2)$
   c. $\mu Idl / (4\pi\sqrt{R})$
   d. $\mu Idl / (2\pi R)$

8. Tangential component of the electric field on a perfect conductor will be
   a. infinite
   b. zero
   c. same as the normal field component and 90° out of phase
   d. same as the normal component but 180^0 out of phase

9. The force f per unit area On the surface of conductor, with surface charge density σ. in the presence of an electric field is (a_n is unit outward normal to the conductor surface)
   a. $\bar{f} = \frac{\sigma^2}{2\epsilon_0}\bar{a}_n$
   b. $\bar{f} = \frac{\sigma^2}{\epsilon_0}\bar{a}_0$
   c. $\bar{f} = \epsilon_0 \sigma^2 \bar{a}_0$
   d. $\bar{f} = 0$

10. Two conducting shells of radii r_1 and r_2 ($r_1 > r_2$), each with a charge 'Q' are placed far apart in uniform external electric field. The space surrounding each shell is filled with the same dielectric material. In this situation, the
   a. shells will not experience any force
   b. shells will experience identical force
   c. shell with radius r_1 will experience a greater force
   d. shell with radius r_2 will experience a greater force

11. When a closed conducting loop 'C' is moving with a constant velocity 'V' through a non-uniform time-varying magnetic field 'B', the voltage induced in the loop is given by
   a. $e = -\int \frac{\partial \bar{B}}{\partial t} d\bar{s}$
   b. $e = -\phi_c \left(\bar{V} \times \bar{B}\right) d\bar{l}$
   c. $e = -\phi_c \left(\bar{B} \times \bar{V}\right) d\bar{l}$
   d. $e = -\int \frac{\partial \bar{B}}{\partial t} d\bar{s} + \phi_c \left(\bar{V} - \bar{B}\right) d\bar{l}$

12. An infinite dielectric slab is uniformly polarized as shown in the figure. The electric field inside the slab given by

   a. $\frac{2P}{\epsilon_0}\bar{n}$
   b. $\frac{2P}{\epsilon_0}\left(-\bar{n}\right)$
   c. $\frac{P}{\epsilon_0}\left(\bar{n}\right)$
   d. $\frac{P}{\epsilon_0}\left(-\bar{n}\right)$

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

List-I

A. $\bar{\nabla}.\bar{D} = \rho$

B. $\bar{\nabla}.\bar{J} = \frac{\partial \rho}{\partial t}$

C. $\bar{\nabla} \times \bar{H} = J_c$

D. $\bar{\nabla} \times \bar{E} = \frac{\partial \bar{B}}{\partial t}$

List-II

1. Ampere's Law
2. Gauss's Law
3. Faraday's Law
4. Continuity equation

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

14. Which of the following pairs of parameters and expressions is/are correctly matched?

1. Characteristic impedance..., $\frac{\bar{E}}{\bar{H}}\sqrt{\epsilon_r}$

2. Power flow density ..... $\overline{\nabla} \times \overline{H}$
3. Displacement current in non-conducting medium ..... $\overline{E} \times \overline{H}$

Select the correct answer using the codes given below:

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

15. If the electric field $\overline{E} = 0.1 te^{-t} a_x$ and $\in = 4 \in_0$, then the displacement current crossing an area of 0.1 m^2 at t = 0 will be

a. zero
b. $0.04 \in_0$
c. $0.4 \in_0$
d. $4 \in_0$

16. The directivity of an isotropic antenna is

a. zero
b. less than unity
c. unity
d. infinity

17. Consider the following statements:

For a uniform plane electromagnetic wave

1. the direction of energy flow is the same as the direction of propagation of the wave. V
2. electric and magnetic fields in time quadrature.
3. electric and magnetic fields are in space quadrature.

Of these statements

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

18. For an air dielectric transmission line. It is found that as the frequency is varied from 50 MHz upward, the current reaches a minimum at 50-01 MHz and then a maximum at 50.04 MHz the distance of the location of the short-circuit from the generator will then be

a. 10 km
b. 2.5V km
c. 1 km
d. not determinable from the given data

19. Consider the following statements:

Piezoelectric materials are useful for converting

1. mechanical energy into electrical energy.
2. electrical energy into mechanical energy.
3. mechanical energy into chemical energy.
4. chemical energy into mechanical energy.

Of these statements

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

20. Which one of the following classes of materials can be categorised as ferrites?

a. Plastics
b. Metals
c. Alloys
d. Ceramics

21. Consider the following in relation to the orbital motion of an electron :

1. State of energy level
2. Orbital angular momentum
3. Angle between the applied magnetic field and angular momentum.

The quantum numbers, l, m and n of an electron in orbit represent respectively

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

22. The correct sequence of increasing order of electrical resistivity of the given materials is

a. Diamond, doped germanium, silicon, gold
b. Gold, silicon, doped germanium, diamond
c. Gold, doped germanium, silicon, diamond
d. Gold, diamond, silicon, doped germanium

23. Fermi level is the

a. highest occupied energy level at zero kelvin
b. highest occupied energy level at 0°C
c. energy level at which electron emission occurs
d. minimum energy level in the conduction band

24. Which one of the following statements is correct?

a. The absence of a hysteresis loop in plot Of polarization against field is proof of

the absence of spontaneous polarization

b. The Curie temperature of a ferroelectric is the temperature above which its spontaneous polarization disappears

c. the curie temperature of a ferroelectric is the temperature below which its spontaneous. polarization disappears

d. Barium titanate is a ferroelectric because its lattice strains spontaneously above the Curie temperature

25. The first critical condition a which free electrons are diffracted in an FCC crystal would occur at which one of the following values of the wave number 'K'/('a' is lattice parameter)

a. $\frac{2}{a}$

b. $\frac{\pi a}{\sqrt{3}}$

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

d. $\frac{\sqrt{3\pi}}{a}$

26. When the time period, of the applied voltage is much shorter than the relaxation time of a polarization process, the loss angle is

a. zero

b. between 0^0 and 90^0.

c. 90^0

d. greater than 90^0

27. A ferromagnetic material exhibits different characteristics above and below the

a. Joule's temperature

b. Faraday temperature

c. Curie temperature

d. Neel temperature

28. Consider the following statements :

If the temperature is increases the resistivity of a metal increases because of

1. decrease in carrier concentration
2. an increase in the extent of scattering of carriers.
3. increase in density of impurity.

Of these statements

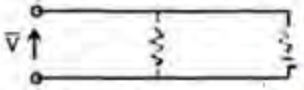
a. 1, 2 and 3 are correct

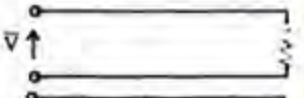
b. 2 alone is correct

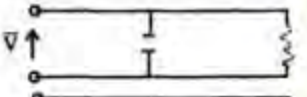
c. 1 alone is correct

d. 2 and 3 are correct

29. Which one of the following is a realistic representation of an equivalent circuit of a condenser containing a lossy dielectric?

a. 

b. 

c. 

d. 

30. The spins in a ferrimagnetic material are

a. all aligned parallel

b. partially aligned antiparallel without exactly canceling out sub-lattice magnetism

c. randomly oriented

d. all aligned antiparallel such that the sub-lattice magnetism cancels out exactly

31. Consider the following functions:

1. To mask against diffusion or ion implant.
2. To act as a component in MOS devices.
3. To provide low resistivity paths.
4. To facilitate the entry of dopants

The functions of an oxide layer on a silicon wafer would include

a. 1 and 2

b. 2 and 3

c. 3 and 4

d. 1 and 4

32. Match List-I (Application) with List-II (Semiconductor) and select the correct answer using the codes given below the lists :

List-I

A. Light emitting diode

B. Gunn diode

C. Thyristor

D. Infra-red detector

List-II

1. Si
2. Gap
3. InSb
4. GaAs

A B C D

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

33. Lithium Niobate is used in
a. SAW devices
b. LED's
c. the manufacture of optical fibres
d. laser diodes

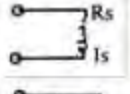
34. Match List-I with List-II and select the correct answer using the codes given below the Lists :

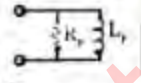
List-I (Malaria)
A. Paramagnetic
B. Diamagnetic
C. Ferromagnetic
D. Ferrimagnetic

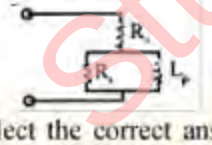
List-II (Magnetic susceptibility)
1. 10^{-5}
2. $10^{3} - 10^{5}$
3. 10^{-3}
4. $10–10^{2}$

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

35. Which of the following is/are the equivalent circuits of an iron-cored, valid at one frequency?

1. 

2. 

3. 

Select the correct answer using the codes given below:
a. 1 alone
b. 2 alone
c. 2 and 3
d. 1, 2 and 3

36. A 10V battery with an internal resistance of 1Ω is connected across a non-linear load whose v-i characteristic is given by

$$7i = v^2 + 2v$$

The current delivered by the battery is
a. 2.5 A
b. 5A
c. 6A
d. 7A

37. A voltage $\overline{V}$ is applied to an ac circuit resulting in the delivery of a current $\overline{I}$. Which of the following expressions would yield the true power delivered by the source ?
1. Real part of $\overline{V}\overline{I}^{*}$
2. Real part of $\overline{V}\overline{I}$
3. F times the real part of $\frac{\overline{V}}{\overline{I}}$

Select the correct answer using the codes given below:
a. 1 alone
b. 1 and 3
c. 2 and 3
d. 3 alone

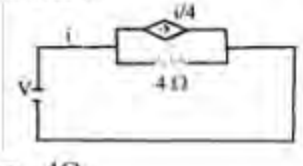
38. Match List-I (Loop concept) with List-II (Junction concept) and select the correct answer using the codes given below the Lists:

List-I
A. Mesh
B. Outside mesh
C. Mesh current
D. Number of meshes

List-II
1. Number of nodes
2. Node voltage
3. Reference node
4. Node

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

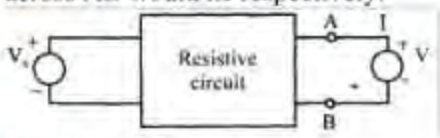
39. In the network shown in the figure, the effective resistance faced by the voltage source is



a. 4Ω
b. 3Ω
c. 2Ω
d. 1Ω

40. For the network shown in the figure, if V = V_1 and V = 0, then = -5 A and if V = 0, and V_1 = 1, then I = 1/2 A. The values of

I_{sc} and R_t of the Norton's equivalent across AB would he respectively.



a. -5 A and 2Ω
b. 10 A and 0.5 Ω
c. 5 A and 2 Ω
d. 2.5 A and 5 Ω

41. The driving-point impedance of a one-port reactive network is given by

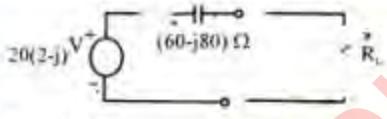
a. $\frac{(s^2+1)(s^2+2)}{s(s^2+3)(s^2+4)}$

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

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

d. $\frac{1}{s+1}$

42. The Thevenin equivalent of a network is as shown in the given figure. For maximum power transfer of the variable and purely resistive load R_L, its resistance should be

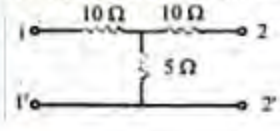


a. 60 Ω
b. 80 Ω
c. 100 Ω
d. infinity

43. If i (t) = 1/4 $(1 - e^{-2t})$ u (t) where u (t) is a unit step voltage, then the complex frequencies associated with i (t) would include

a. s = 0 and j2
b. s = j2 and s = -j2
c. s = -j2 and s = -2
d. s = 0 and s = -2

44. A T-network is shown in the given figure. Its Y_{sc} matrix will (units in siemens)



a. $\begin{bmatrix} \frac{10}{200} & \frac{5}{200} \\ \frac{5}{200} & \frac{10}{200} \end{bmatrix}$

b. $\begin{bmatrix} \frac{10}{200} & \frac{-5}{200} \\ \frac{-5}{200} & \frac{10}{200} \end{bmatrix}$

c. $\begin{bmatrix} \frac{15}{200} & \frac{-5}{200} \\ \frac{5}{200} & \frac{15}{200} \end{bmatrix}$

d. $\begin{bmatrix} \frac{15}{200} & \frac{5}{200} \\ \frac{5}{200} & \frac{15}{200} \end{bmatrix}$

45. The time-constant to the network shown in the figure is

a. CR
b. 2CR
c. CR/4
d. CR/2

46. For a two-port network to be reciprocal, it is necessary that

a. $Z_{11} = Z_{22}$ and $y_{21} = y_{12}$
b. $Z_{11} = Z_{22}$ and AD - BC = 0
c. $h_{21} = -h_{12}$ and AD – BC = 0
d. $y_{21} = y_{12}$ and $h_{21} = - h_{12}$

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

List-I

A. h_{11}
B. h_{12}
C. h_{22}

List-II

1. Dimensionless
2. Ohms
3. Siemens

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

48. Two two-port networks with transmission parameters A_1, B_1, C_1, D_1, and A_2, B_2, C_2,

D_2 respectively are cascaded. The transmission parameter matrix of the cascaded network will be

a. $\begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} + \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix}$

b. $\begin{bmatrix} A_1 & B_1 \\ C_1 & D_1 \end{bmatrix} \begin{bmatrix} A_2 & B_2 \\ C_2 & D_2 \end{bmatrix}$

c. $\begin{bmatrix} A_1 & A_2 & B_1 & B_2 \\ C_1 & D_2 & D_1 & D_2 \end{bmatrix}$

d. $\begin{bmatrix} (A_1A_2 + C_1C_2)(A_1B_2 + B_1D_2) \\ (C_1A_2 - C_1C_2)(C_1C_2 - D_1D_2) \end{bmatrix}$

49. An initially relaxed RC-series network with R = 2MΩ and C = 1μF is switched on to a 10 V step input. The voltage across the capacitor after 2 seconds will be
a. zero
b. 3.68 V
c. 6.32 V
d. 10 V

50. On eliminating the feedback loop in the system shown in the figure,

it would lead to a simplification with a single edge of gain

a. $\frac{T_{12}}{1+T_{22}}$

b. $\frac{T_{22}}{1-T_{12}}$

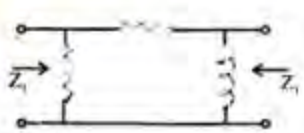
c. T_{12}

d. $\frac{T_{12}}{1-T_{22}}$

51. For the circuit shown in the given figure. if the input impedance Z_1 at port 1 is given by

$$Z_1 = \frac{K_1(s+2)}{s+5}$$

then the input impedance Z_2 at port 2 will be



a. $\frac{K_2(s+3)}{s+5}$

b. $\frac{K_2(s+2)}{s+3}$

c. $\frac{K_2 s}{s+5}$

d. $\frac{K_2 s}{s+2}$

52. For $V(s) = \frac{s+2}{s(s+1)}$ the initial and final values of v (t) will be respectively
a. 1 and 1
b. 2 and 2
c. 2 and 1
d. 1 and 2

53. The net work function

$$F(s) = \frac{(s+2)}{(s+1)(s+3)}$$

represents an
a. RC impedance
b. RL impedance
c. RC impedance and an RL admittance
d. RC admittance and an RL impedance

54. In the network shown in Fig. 1, if the IF capacitor had, an initial voltage of 2V, then which of the following would represent the s-domain equivalent circuits?

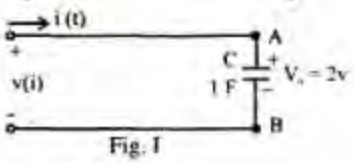
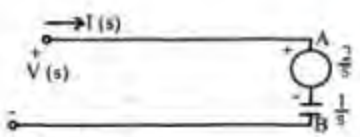


Fig. I

1.



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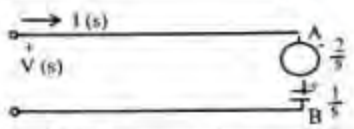

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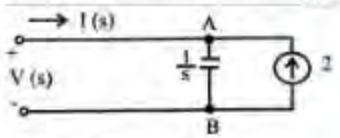
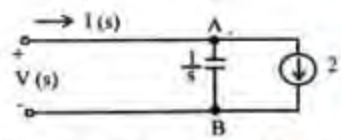


4.



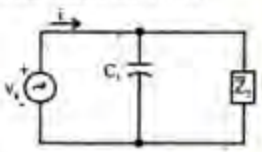
Select the correct answer using the codes given below:
a. and 3

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

55. An initially relaxed 100 mH inductor is switched 'ON' at t = 1 sec. to an ideal 2 A dc current source. The voltage across the inductor would be
a. zero
b. 0.2 δ (t–1) V
c. 0.2 δ (t–1) V
d. 0.2 tu (t–l) V

56. The current through the current coil, of a wattmeter is given by
i = (1 + 2 sin ω t) A
and the voltage across the pressure coil is
v = (2 + 3 sin 2 ω t) V
The wattmeter will read
a. 8.00 W
b. 5.05 W
c. 2.0 W
d. 1.0 W

57. In the circuit shown in the figure, $v_s = \cos 2t$, $\overline{Z}_2 = 1 + j$. C_1 is so chosen that $i = 1 \cos 2t$. The value of C_1 is



a. 2 F
b. 1 F
c. 0.5 F
d. 0.25 F

58. An RLC resonant circuit has a resonance frequency of 1.5 HMz and a bandwidth of 10 kHz. If C = 150 pF, then the effective resistance of the circuit will be
a. 29.5 Ω
b. 14.75 Ω
c. 9.4 Ω
d. 4.7 Ω

59. A 3-phase, 3 wire supply feeds a load consisting of three equal resistors connected in star. If one of the resistors in open circuited, then the percentage reduction in the load will be
a. 75
b. 66.66
c. 50
d. 33.33

60. Two identical coils of negligible resistance, when connected in series across a 50 Hz fixed voltage source, draw a current of 10A. When the terminals of one of the coils are reversed, the current drawn is 8A. The coefficient of coupling between the two coils is
a. 1/100
b. 1/9
c. 4/10
d. 8/10

61. The voltage-ratio transfer function of an active filter is given by

$$\frac{V_2(s)}{V_1(s)} = \frac{(s^2 + \delta)}{(s^2 + \alpha s + \delta)}$$

The circuit in questions a
a. low- pass filter
b. high-pass filter
c. band-pass filter
d. band-reject filter

62. Swamping resistance is a resistance which is added to the moving coil of meter to
a. reduce the full-scale current
b. reduce the temperature error
c. increase the sensitivity
d. increase the field strength

63. The dimensional equation of resistance is
a. $L^2 MT^{-2} I^{-2}$
b. $L^2 MT^{-2} I^{-2}$
c. $L^2 M^{-3} I^{-2}$
d. $L^2 MT^{-3} I^{-2}$

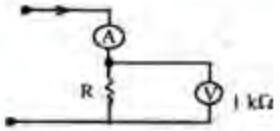
64. A high frequency ac signal is applied to a PMMC instrument. If the rms value of the ac signal is 2 V, then the reading of the instrument will be
a. zero
b. 2V
c. $2\sqrt{2V}$
d. $4\sqrt{2V}$

65. The resistance of a shunt for a precision grade ammeter can be best measured by
a. De Sauty bridge
b. Scherring bridge
c. Maxwell bridge
d. Kelvin double bridge

66. Which one of the following has the highest accuracy?
a. Standard resistance
b. Standard inductance
c. Standard capacitance
d. Standard mutual inductance

67. In the circuit shown in the figure, is the ammeter indicated 1A, and the voltmeter

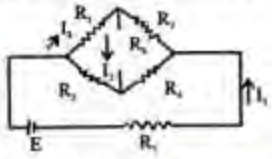
having an internal resistance of 1 kΩ indicated 100 V, then the value of R would be



a. 111.11 Ω
b. 105.2 Ω
c. 100 Ω
d. 90.9 Ω

68. The current 'I' through a resistance R is measured with the following uncertainties
I = 4A ± 0.5 %
R= 100 Ω ± 0.2%
If power is computed from these two measured quantities, the uncertainty in the power computed will be
a. ± 0.01%
b. ± 0.29 %
c. ± 0.07 %
d. ± 1.2 %

69. In the balanced Wheatstone bridge shown in the figure. If the value of R_6 is increased, the current I_2



a. will increase
b. will decrease
c. will remain unchanged
d. may increase of decrease depending upon the values of the other five resistances

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

List-I
A. Low value, of R
B. High- Q inductor
C. Low - Q inductor
D. High voltage capacitors

List-II
1. Scherring bridge
2. Maxwell bridge
3. Kelvin double bridge
4. Hay bridge

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

71. An indicating instrument is more sensitive if its torque to weight ratio is
a. much larger than unity
b. of the order of unity
c. much less than unity
d. made deflection-dependent

72. The X-and Y - inputs of a CRO are respectively V sin ωt and -V sin ωt. The resulting Lissajous pattern will be
a. a straight line
b. a circle
c. an ellipse
d. a figure of eight

73. A current i = (10 + 10 sin t) amperes is passed through an ideal moving iron type ammeter. Its reading will be
a. zero
b. 10 A
c. $\sqrt{150}A$
d. $10\sqrt{2}A$

74. In a Q-meter, a small resistance R is added to the series resonance circuit to inject the oscillatory voltage to the circuit. If R_s is the apparent series resistance of the circuit at resonance, then the value of the actual Q will be equal to
a. observed Q $\dfrac{1}{1+\dfrac{R}{R_s}}$
b. observed Q $\left(1+\dfrac{R}{R_s}\right)$
c. Observed Q $\dfrac{1}{1+\dfrac{R_s}{R}}$
d. Observed Q $\left(1+\dfrac{R_s}{R}\right)$

75. In a flux meter, the controlling torque is
a. produced by weights attached to the moving coil
b. produced by springs
c. not provided at all
d. provided by crossed coil mechanism

76. Dummy strain gauge is used in conjunction with the main strain gauge to
a. calibrate the system
b. compensate temperature effects.
c. improve sensitivity

d. reduce strain on the main gauge

77. In a two-wattmeter method of measuring power, one of the watt- meters is reading zero watts. The power factor of the circuit is
a. Zero
b. 1
c. 0.5
d. 0.8

78. Hall effect device can be used to
a. multiply two signals
b. divide one signal by another on an instantaneous basis
c. add two signals
d. subtract one signal from another

79. Match List-I (Transducer) with List-II (Input/Output variables) and select the correct answer using the codes given below the Lists:

List-I
A. Electrodynamic generator
B. Venturimeter
C. Pirani gauge
D. Spring balance

List-II
1. Gas pressure to resistance change
2. Force to displacement
3. Motion to voltage
4. Flow rate to pressure

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

80. Doppler shift principle is used in the measurement of
a. temperature
b. frequency
c. speed
d. pressure

81. In distortion factor meter, the filter is used to suppress
a. dc component
b. odd harmonics
c. even harmonics
d. fundamentals

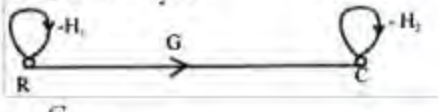
82. Which of the following measurements can be made with the help of a frequency counter?
1. Fundamental frequency of input signal.
2. Frequency components of the input signal at least upto third harmonic.
3. Time interval between two pulses.
4. Pulse width.

Select the correct answer using the codes given below:
a. 1, 3 and 4
b. 1, 2 and 3
c. 2 and 4
d. 1 and 2

83. The bandwidth requirement of an FM telemetry channel is
a. equal to that of an AM telemetry channel
b. smaller than that of an Am telemetry channel
c. about 100 times that of an AM telemetry channel
d. about ten time that of an AM telemetry channel

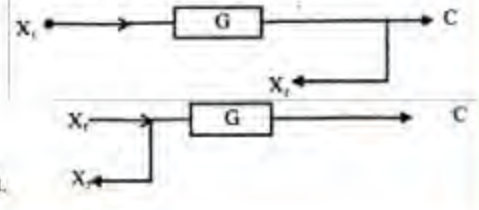
84. The recording head in a magnetic tape responds to
a. electrical signal and creates a magnetic signal
b. thermal signal and creates a magnetic signal
c. magnetic signal and creates an electrical signal
d. thermal signal and creates an electrical signal

85. When the signal flow graph is as shown in the figure, the overall transfer function of the system will be

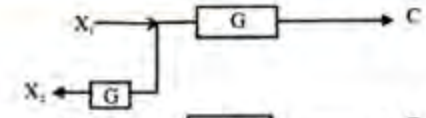


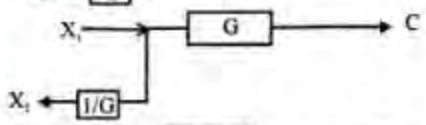
a. $\frac{C}{R} = G$
b. $\frac{C}{R} = \frac{G}{1+H_2}$
c. $\frac{C}{R} = \frac{G}{(1+H_2)(1+H_2)}$
d. $\frac{C}{R} = \frac{G}{1+H_2+H_2}$

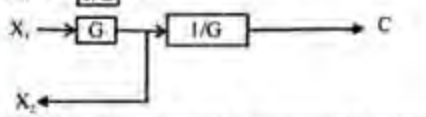
86. The block diagram shown in Fig. 1 is equivalent to



a.

b.


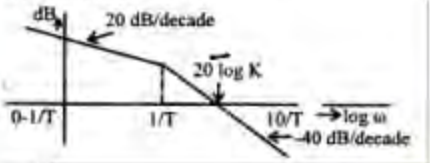
c.


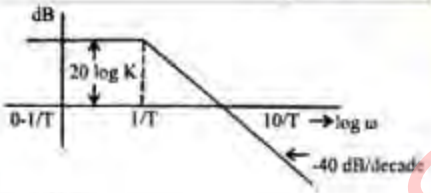
d.


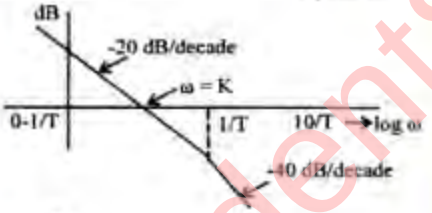
87. The transfer function of a system is given by

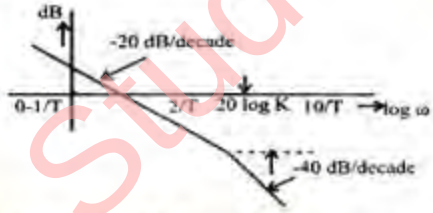
$$C(j\omega)=\frac{K}{(j\omega)(j\omega T+1)},\ K<\frac{1}{T}$$

Which one of the following is the Bode plot of this function?

a.


b.


c.


d.


88. Match List-I (Mathematical expression) with List-II (Nomenclature) and select the correct answer using the codes given below the Lists :

List-I

A. $\int_{-\infty}^{\infty} h(t-\tau)x(\tau)d\tau$

B. $\int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt$

C. $\int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt$

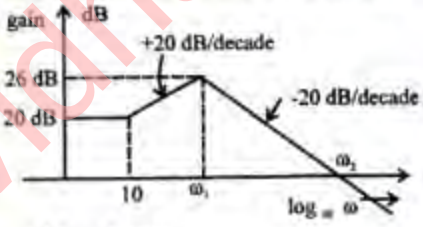
D. $\int_{-\infty}^{\infty} \delta(t)dt$

List-II

1. Step function
2. Convolution integral
3. Fourier transform
4. Laplace transform

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

89. The magnitude-frequency response of a control system is shown in the figure. The value of ω_1 and ω_2 are respectively



a. 10 and 200
b. 20 and 200
c. 20 and 400
d. 100 and 400

90. A liner second-order system with the transfer function

$$G(s)=\frac{49}{s^2+16s+49}$$

is initially at rest and is subjected to a step input signal. The response of the system will exhibit a peak overshoot of

a. 16 %
b. 9 %
c. 2 %
d. zero

91. A system has the following transfer function :

$$G(s)=\frac{100(s+5)(s+50)}{s^3(s+10)(s^2+3s+10)}$$

The type and order of the system are respectively

a. 4 and 9
b. 4 and 7
c. 5 and 7
d. 7 and 5

92. The open-loop transfer function of a unity-feedback control system is:

$$G(s)=\frac{K(s+10)(s+20)}{s^2(s+2)}$$

The closed-loop system will be stable if the value of K is

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

93. Match List-I (Plot/diagram/chart) with List-II (Characteristic) and select the correct answer using the codes given below the lists :

List-I

A. Constant M loci
B. Constant N loci
C. Nichol's chart
D. Nyquist plot

List-II

1. Constant gain and phase shift loci of the closed- loop system.
2. Plot of loop gain with variation of ω
3. Circles of constant gain for closed loop transfer function
4. Circles of constant phase shift of closed - loop transfer function

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

94. The state and output equations of a system are as under state equation:

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix}=\begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}+\begin{bmatrix} 0 \\ 1 \end{bmatrix}u(t)$$

$$\text{Output equation}: C(t)=[1\ \ 1]\begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

The system is

a. neither state controllable nor output controllable
b. state controllable but not output controllable
c. output controllable but not state controllable
d. both state controllable and output controllable

95. The loop transfer function GH of a control system is given by

$$GH=\frac{K}{s(s+1)(s+2)(s+3)}$$

Which of the following statements regarding the conditions of the system root loci diagram is/are correct?

1. There will be four asymptotes.
2. There will be three separate root loci.
3. Asymptotes will intersect at real axis at $\sigma_A=-2/3$

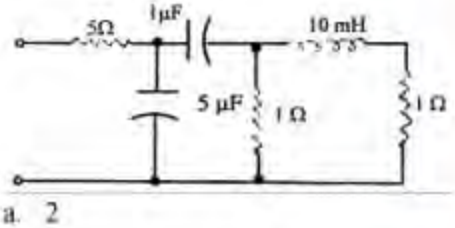
Select the correct answer using the codes given below:

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

96. The value of A matrix in X = AX for the system described by the differential equation $\ddot{y}+2\dot{y}+3y=0$ is

a. $\begin{bmatrix} 1 & 0 \\ -2 & -1 \end{bmatrix}$
b. $\begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix}$
c. $\begin{bmatrix} 0 & 1 \\ -2 & -1 \end{bmatrix}$
d. $\begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix}$

97. The minimum number of states necessary to describe the network shown in the figure in a state variable form is



a. 2
b. 3
c. 4
d. 6

98. Consider the following statements regarding a linear system $y=f(x_2)$:

1. $f(x_1+x)=f(x_1)+f(x_2)$
2. $f[x(t+T)=f[x(t)]+f[x(T)]$
3. $f(Kx)=Kf(x)$

Of these statements

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

d. 1 and 3 are correct

99. When the input to a system was withdrawn at t = 0, its output was found to decrease exponentially from 100 units to 500 units. in 1.386 seconds.. The time constant of the system is
a. 0.500
b. 0.693
c. 1.386
d. 2.000

100. Match List - I (System) with List - II (Transfer function) and select the correct answer using the codes given below the Lists:

List-I

A. AC servomotor
B. DC amplifier
C. Lead network
D. Lag network

List-II

1. $\frac{s+z}{s+p}(z<p)$
2. $\frac{1+T_1S}{1+T_2S}(T_1<T_2)$
3. $\frac{K}{1+Ts}$
4. $\frac{K}{s(1+Ts)}$

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

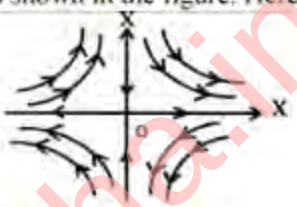
101. Consider the following statements regarding constructional features of synchros :
1. Synchro repeater has a three-phase stator and a three-phase rotor.
2. Disc shaped rotor of the synchro control transformer offers a low reluctance to the magnetic path
3. Synchro transmitter has a frictionless bearing.

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

102. Which of the following motors would be suitable for, use as servomotors?
1. Two-phase induction motor
2. DC separately excited motor.
3. Single- phase capacitance start induction motor.
4. Universal motor.
5. Single-phase synchronous motor.

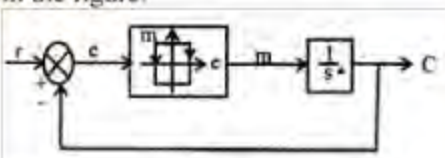
Select the correct answer using the codes given below :
a. 1, 2, 3, 4 and 5
b. 2, 3 and 4
c. 1, 2 and 5
d. 1 and 5

103. The phase portrait of a non-linear system is shown in the figure. Here the origin is a

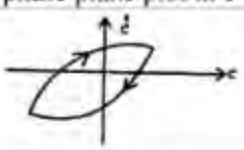


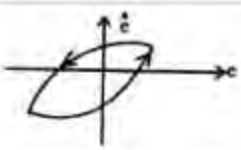
a. stable focus
b. vortex
c. stable node
d. saddle point

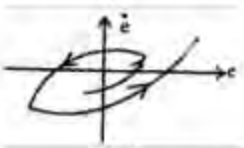
104. A closed-loop nonlinear system is shown in the figure:

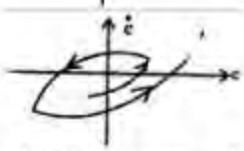


The phase plane plot in e-ė plane is:

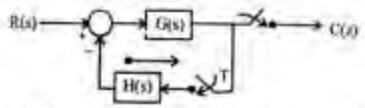
a. 

b. 

c. 

d. 

105. The block diagram of a sampled data system is shown the figure:



The output C (z) of the system is given by

a. $\frac{GR(z)}{1+GH(z)}$

b. $\frac{G(z)R(z)}{1+GH(z)}$

c. $\frac{GR(z)}{1+G(z)H(z)}$

d. $\frac{G(z)R(z)}{1+G(z)H(z)}$

106. Assertion (A) : Static electric field and equipotential lines are orthogonal.
Reason (R) : $\int \vec{E}.d\vec{l} = 0$
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

107. Assertion (A) : The static magnetic field has zero divergence and non-zero curl.
Reason (R) : They static magnetic field satisfies the flux law.
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

108. Assertion (A) : A glazed ceramic insulator has a lower breakdown strength than an unglazed one.
Reason (R) : Glazing covers pores and cracks and makes the surface non-absorbent.
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

109. Assertion (A) : In a type II superconductor, the magnetization gradually decreases between two critical values of the applied field H_{C1} and H_{C2}.
Reason (R) : In a type II superconductor, magnetic flux lines are pinned by micro structural imperfections.
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

110. Assertion (A) : In an alternating field of 10^{14} H_z, the electrical conductivity of a metal is zero
Reason (R) : As the electrons fail to respond to the fast changing electric field, there is no drift.
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

111. Assertion (A) : Addition of boron to intrinsic or pure silicon in the proportion of one boron atom to 10^{15} silicon atom increases the conductivity of pure silicon by a factor of 10^3 at room temperature.
Reason (R) : Addition of impurities to intrinsic semiconductors increases carrier 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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

112. Assertion (A) : A network consisting of 'n' nodes and 'e' elements can be completely analysed from (e-n +1) mesh equations or (n-1) node equations.
Reason (R) : The number of mesh equations plus number of node equations is equal to the number of elements in the network.
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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

113. Assertion (A) : The poles and zeros of a reactance function alternate on the s-plane.

Reason (R) : The plot of a reactance function as a function of frequency always has a positive slope.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

114. Assertion (A) : The steady-state response of a linear network is termed 'forced response.

Reason (R) : The forcing function does not have any effect on the transient response of a linear system.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

115. Assertion(A) : A variance is dependent on the mean value of the set of data.

Reason (R) : Variance is the difference of the mean squared values and the square of the mean value of the set of data.

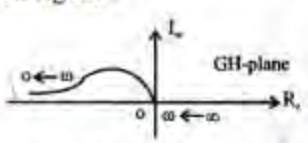
a. Both A and R are true and R is the correct explanation of A
b. Both A and Rare true but R is NOT a correct explanation of A
c. A is true but R is false
d. A is false but R is true

116. Assertion (A) : The vertical deflecting plates of a CRT are kept farther away from the screen as compared to the horizontal deflecting plates.

Reason (R) : This improves accuracy in measurements.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

117. The Nyquist plot of a system with the loop transfer function G(s) H(s) is shown in the given figure :



Assertion (A) : The system is unstable.

Reason (R) : The Nyquist plot does not encircle the critical point (-1, j0).

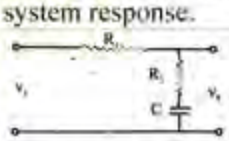
a. Both A and R are true and R is the correct explanation of A
b. Both A and Rare true but R is NOT a correct explanation of A
c. A is true but R is false
d. A is false but R is true

118. Assertion (A) : When plant parameter uncertainties are present, the open-loop structure is potentially superior to the closed loop structure.

Reason (R) : When feedback is employed, there is a possibility of additional noise or uncertainty in the measurement of the plant signals.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

119. Assertion (A) : The compensating network shown in the given figure is used for reduction of steady-state error in the system response.



Reason (R) : A lead compensating network reduces system steady-state error.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true

120. A sampled data system has the following characteristic equation in the r-plane

$$3.5r^3 - 2.5r^2 + 0.5r + 2.5r = 0$$

where $r = \dfrac{z-1}{z+1}$

Assertion (A) : The system is unstable.

Reason (R) : Not all the roots, of the characteristic equation F (z) = 0 lie within the unit circle |z| = 1 in the z - plane.

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 a correct explanation of A
c. A is true but R is false
d. A is false but R is true