ELECTRICAL ENGINEERING

PAPER–I

1. Vacant lattice sites in halide crystals cause
   a. plastic deformation and ionic conductivity
   b. transparency and diffusion
   c. diffusion and ionic conductivity
   d. plastic deformation and transparency
2. In a linear chain of atoms of interatomic distance '*l*', the first Brillouin zone occurs between wave numbers
   a. $-\pi / l \text{ and } +\pi / l$
   b. $-2\pi / l \text{ and } +2\pi / l$
   c. Zero and $2\pi / l$
   d. $-1/e \text{ and } +1/l$
3. The temperature coefficient of resistance of an insulator is
   a. positive and independent of temperature
   b. negative and independent of temperature
   c. negative and dependent on temperature
   d. positive and dependent on temperature
4. Match List I (Dielectric) with List II (Loss-tangent) and select the correct answer using the codes given below:
   List I
   A. Teflon
   B. Polystyrene
   C. Bakelite
   D. Glass
   List II
   1. 5×10^{-5}
   2. 3×10^{-2}
   3. 5×10^{-4}
   4. 7.7×10^{-3}

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

5. Piezoelectric materials owe their property to the
   a. presence of a centre of symmetry
   b. lack of a centre of symmetry
   c. presence of axis of symmetry
   d. lack of axis of symmetry
6. If E - E_F = 2kT (E_F is Fermi energy and 'k', the Boltzmann's constant is 8.614 x 10^{-5} eVK^{-1}), then the probability that an electron occupies an energy level 'E' is
   a. 0.63
   b. 0.5
   c. 0.27
   d. 0.12
7. Match List I (Material) with List II (Superconducting transition temperature) and select the correct answer:
   List I
   A. Sn
   B. Nb_3 Ge
   C. Y-Ba-Cu oxide
   D. Bi-Sr-Ca-Cu oxide
   List II
   1. 23 K
   2. 4 K
   3. 125 K
   4. 90 K
   Codes;

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

8. Match List I (Type of magnetism) with List II (Material) and select the correct answer:
   List I
   A. Diamagnetic
   B. Ferromagnetic
   C. Antiferromagnetic
   D. Ferromagnetic
   List II
   1. Ge
   2. NiO
   3. Ferrites
   4. Cobalt.
   Codes;

	A	B	C	D

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

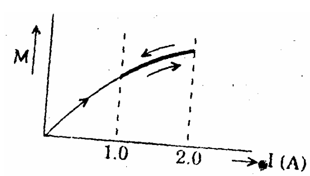
9. Consider the following statements:
Permanent magnet dipoles in matter result from
1. orbital angular momentum of electrons
2. electron spin angular momentum
3. nuclear spin angular momentum

Which of these statements are correct?
a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 1, 2 and 3

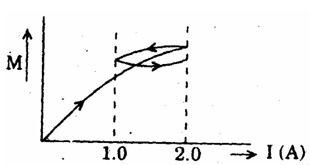
10. The phenomenon by which a ferromagnetic material is magnetized to its final state by a magnetic field is attributed to
a. eddy currents and magnetic viscosity
b. magnetic viscosity and hysteresis
c. hysteresis and eddy currents
d. aging and magnetic viscosity

11. The current in a coil wound over a ferromagnetic core is gradually increased to 2 A and then reduced to 1 A and then the current in it is again increased to 2 A. The variation of magnetization of the core will be as shown in

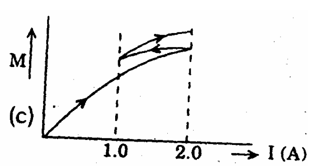
a.



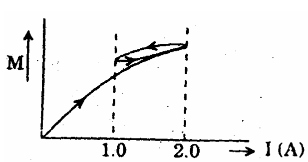
b.



c.



d.



12. The total iron loss in a transformer core at normal flux density was measured at 25 Hz and at 50 Hz and was found to be 250 W and 800 W respectively. The hysteresis loss at 50 Hz would be
a. 100W
b. 150W
c. 200W
d. 600W

13. Consider the following statements:
During an electron transition across the energy gap in GaAs, its
1. momentum changes
2. direction of motion changes
3. potential energy changes
4. kinetic energy remains constant

Which of these statements are correct?
a. 3 and 4
b. 2 and 3
c. 1 and 2
d. 1 and 4

14. Match List I (Semiconductor property) with List II (Type of semiconductor) and select the correct answer

List I
A. Electron mobility of 0.13 $m^2V^{-1}s^{-1}$
B. p-type
C. n-type
D. Wide band gap

List II
1. Germanium doped with arsenic
2. Gallium arsenide
3. Silicon
4. Gallium doped silicon

Codes;

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

15. The Hall coefficient of a sample of silicon having 10^{22} arsenic atoms per m^3 is
a. $3.49 \times 10^{-3} m^3/C$
b. $6.25 \times 10^{-4} m^3/C$
c. $1.37 \times 10^{-4} m^3/C$
d. $9.44 \times 10^{-5} m^3/C$

16. The ceramic dielectrics used in electrical engineering in- dude
a. cermet and suicide
b. porcelain and cermet
c. cordierite and porcelain

d. suicide and cordierite

17. 17. Liquid crystal maternal is used in

a. ultrasonic amplification and display devices
b. thermal sensors and transducers
c. display devices and thermal sensors
d. transducers and ultrasonic amplification

18. Match List I (Semiconductor) with List II (Band gap in eV) and select the correct answer:

List I
A. GaAs
B. InP
C. InGaAs
D. GaAIAs

List I
1. 1.8
2. 1.43
3. 1.35
4. 0.75

Codes;

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

19. Assertion (A): The relative dielectric constant

Reason (R): With increase in frequency of the applied field, the polarization processes increase in number.

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

20. Assertion (A): Inasemiconductor, the Hall field per unit electric current density per unit magnetic flux maybe zero.

Reason (R): The Hall coefficient is proportional $\left(p\mu_h^2 - n\mu_e^2\right)$.

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

21. Assertion (A): A piezoelectric transducer is not suitable for measurement of static pressure.

Reason (R): Piezoelectric effect is a reversible phenomenon.

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

22. Assertion (A): The mechanical systems of analog indicating instruments are critically damped.

Reason (R): It is desirable that the pointer of an indicating instrument overshoots a little above its equilibrium position quickly.

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

23. Assertion (A): The measurement of impedance by bridge method is more accurate than the direct method using indicating instruments.

Reason (R): The accuracy of the detector does not affect the accuracy of measurement in a bridge method.

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

24. Assertion (A): Electric field cannot exist inside a perfect conductor.

Reason (R): For a perfect conductor a = ∞ and there is no voltage drop inside the conductor.

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

25. Assertion (A): In a current-carrying cylindrical conductor, the magnetic field intensity within the conductor increases linearly with radial distance.

Reason (R): The enclosed current increases as the square of the radial distance while the perimeter increases only as the radial distance.

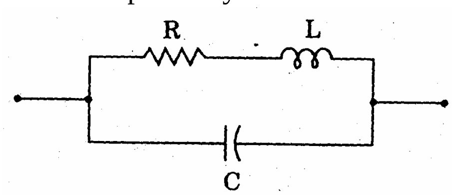
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is NOT the correct explanation of A
c. A is true but R is false
d. A is false but R is true

26. Assertion (A): An unstable control system possesses at least a pair of complex conjugate roots in its s-plane.

Reason (R): Complex conjugate roots always give rise to oscillating responses.

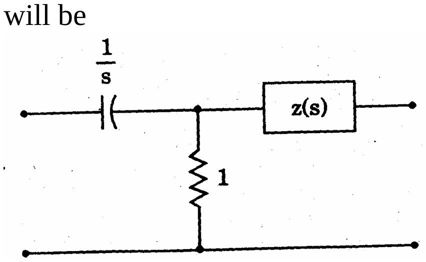
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is NOT the correct explanation of A
c. A is true but R is false
d. A is false but R is true

27. If the driving-point impedance function $\frac{2s+1}{8s^2+4s+1}$ is synthesized as shown in the given figure, then the values of R, L and C will be respectively



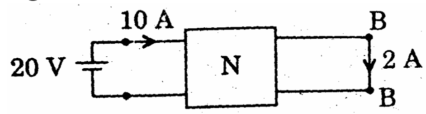
a. 1, 2 and 4
b. 2, 1 and 4
c. 1, 4 and 2
d. 4, 2 and 1

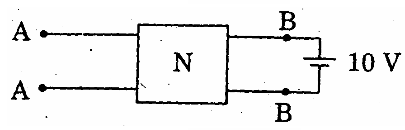
28. If the two-port network shown in the given figure has the constant B $\frac{2s+1}{s^2}$ then z(s) will be



a. s
b. 1/s
c. s + 1
d. 1 + 1/s

29. The short-circuit test of a 2-port network is shown in figure-I. The voltage across the terminals AA in the network shown in figure-II will be





a. 20V
b. 10V
c. 5V
d. 2V

30. In a passive two-port network, the open-circuit impedance matrix is

$$\begin{bmatrix} 10\,\Omega & 2\,\Omega \\ 5\,\Omega & 5\,\Omega \end{bmatrix}$$

If the input port is interchanged with the output port, then the open-circuit impedance matrix will be

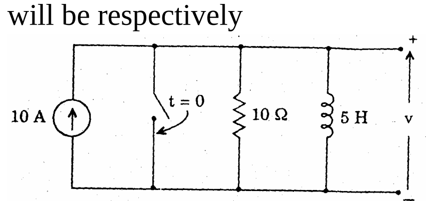
a.
$$\begin{bmatrix} 10\,\Omega & 2\,\Omega \\ 5\,\Omega & 5\,\Omega \end{bmatrix}$$

b.
$$\begin{bmatrix} 5\,\Omega & 2\,\Omega \\ 2\,\Omega & 10\,\Omega \end{bmatrix}$$

c.
$$\begin{bmatrix} 5\,\Omega & 10\,\Omega \\ 2\,\Omega & 2\,\Omega \end{bmatrix}$$

d.
$$\begin{bmatrix} 2\,\Omega & 5\,\Omega \\ 10\,\Omega & 2\,\Omega \end{bmatrix}$$

31. In the circuit shown in the given figure, if the switch is closed at t = 0, then the voltage $v(0^+)$ arid its derivative $dv/dt|_{t=0^+}$ will be respectively



a. 10 V and 50 V/s
b. 10 V and -50 V/s

c. 100 V and 200 V/s

d. 100 V and -200 V/s

32. Five cells are connected in series in a row and then four such rows are connected in parallel to feed the current to a resistive load of 1.25Ω. Each cell has emf of 1.5 V with internal resistance of 0.2Ω. The current through the load will be

a. 3.33 A

b. 23.33A

c. 5A

d. 1A

33. The mutual inductance between two coupled coils is 10 mH. If the turns in one coil are doubled and that in the other are halved, then the mutual inductance will be

a. 5 mH

b. 10 mH

c. 14 mH

d. 20 mH

34. Four resistance 80Ω, 50Ω, 25Ω and R are connected in parallel. Current through 25Ω resistance is 4A. Total current of the supply is 10 A. The value of R will be

a. 66.66 Ω

b. 40.25 Ω

c. 36.36 Ω

d. 76.56 Ω

35. A function f(t) = sin 1.1t + sin 3.3t has the time period of

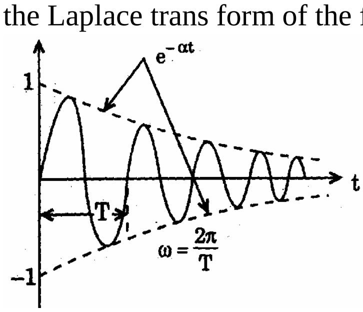
a. π / 1.1

b. 2π / 1.1

c. 2π/3.3

d. π/2.2

36. The response shown in the given figure is the Laplace trans form of the function



a. $\dfrac{\omega}{(s+\alpha)^2+\omega^2}$

b. $\dfrac{\alpha}{(s+\alpha)^2+\omega^2}$

c. $\dfrac{s+\alpha}{(s+\alpha)^2+\omega^2}$

d. $\dfrac{s}{(s+\alpha)^2+\omega^2}$

37. Consider the following statements:
The impulse response of a linear network can be used to determine the

1. step response
2. response of the sinusoidal input
3. elements of the network uniquely
4. interconnection of network elements

Which of these statements are correct?

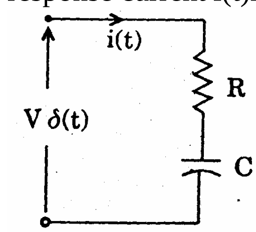
a. 1 and 2

b. 2 and 3

c. 3 and 4

d. 1 and 4

38. In the circuit shown in the given figure, the response current i(t)is.



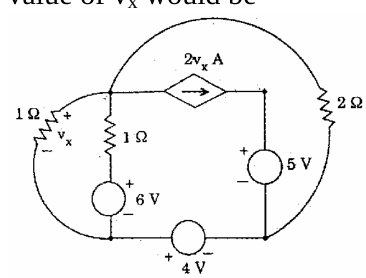
a. $\dfrac{V}{R}\exp\left(-\dfrac{t}{RC}\right)$

b. $\dfrac{V}{R}\delta(t)$

c. $\dfrac{V}{R}\left[\delta(t)-\dfrac{t}{RC}\exp\left(-\dfrac{t}{RC}\right)\right]$

d. $\dfrac{V}{R}\left[\delta(t)-\exp\left(-\dfrac{t}{RC}\right)\right]$

39. In a network shown in the given figure, the value of v_x would be



a. -8/9 V

b. 8/9V

c. 16/9V

d. -16/9 V

40. To improve the power factor in three-phase circuits, the capacitor bank is connected in delta to make

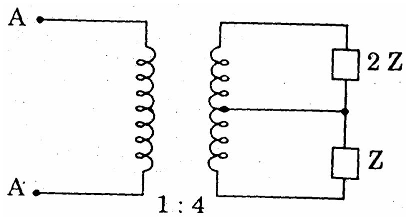
a. capacitance calculation easy

b. capacitance value small

c. the connection elegant
d. the power factor correction more effective

41. A three-phase heating unit and induction motor are connected in parallel across a 208 V three-phase supply. Motor is rated at 5 hp, 0.9 pf with efficiency of 0.85. Heating unit is rated at 1500 W The line current will be equal to
a. 185A
b. 1.85 V
c. 18.5 V
d. 15 V

42. If an ideal centre-tapped 1: 4 transformer is loaded as shown in the figure, the impedance measured across the terminals AA would be



a. 3Z/16
b. 3Z/18
c. 2Z/3
d. Z/6

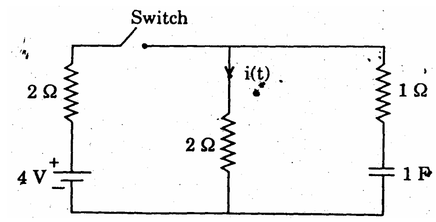
43. A 10 μF capacitor is fed from an ac voltage source containing a fundamental and a third harmonic of value one-third of fundamental. The third harmonic current flowing through the Capacitor expressed as percentage of the fundamental under steady- state condition will be
a. zero
b. 100
c. 30
d. 90

44. In a two-element series circuit, the applied vo1tage and the resulting current are respectively,
$v(t) = 50 + 50 \sin (5 \times 10^3 t)$ V and
$i(t) = 11.2 \sin (5 \times 10^3 t + 63.4°)$A
The nature of the elements would be
a. R—L
b. R—C
c. L — C
d. neither R, nor L. nor C

45. In a balanced Wheatstone bridge, if the positions of detector and source are interchanged, the bridge will still remain balanced. This inference can be drawn from
a. reciprocity theorem
b. duality principle
c. compensation theorem
d. equivalent theorem

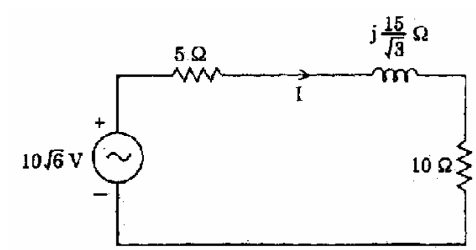
46. A voltage $v(t) = 6 e^{-2t}$ is applied at t = 0 to a series R - L circuit with L = 1H. If i(t) = 6[exp (-2t) - exp (-3t) then R will have a value of
a. 2/3 Ω
b. 1 Ω
c. 3 Ω
d. 1/3 Ω

47. In the circuit shown, the switch is opened at t = 0. Prior to that switch was closed, i(t) at t = 0* is



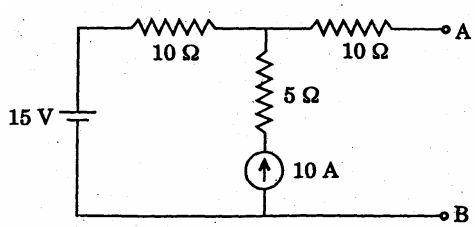
a. 2/3A
b. 3/2A
c. 1/3A
d. 1A

48. Consider the following statements regarding the circuit shown in the figure. If the power consumed by 5 Ω is 10 W, then
1. $|I| = \sqrt{2A}$
2. the total impedance of the circuit is 5W
3. $\cos\phi = 0.866$



Which of these statements are correct?
a. 1 and 3
b. 2 and 3
c. 1 and 2
d. 1, 2 and 3

49. In the network shown in the given figure, the Thevenin source and the impedance across terminals A — B will be respectively



a. 15V and 13.33 Ω
b. 50 V and 15 Ω
c. 115 V and 20 Ω
d. 100 V and 25 Ω

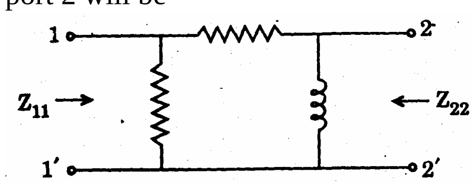
50. For the function

$$\mathcal{L}[f(t)] = \frac{3s+1}{s(s^2+4s+5)} \quad df \backslash dt \Big|_{t=0^+}$$

a. 3
b. 1/3
c. Zero
d. 2/3

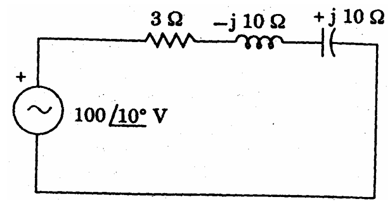
51. An arc source of 200 V rms supplies active power of 600 W and reactive power of 800 VAR. The rms current drawn from the source is
a. 10 A
b. 5 A
c. 3.75 A
d. 2.5 A

52. In the given 2-port network, if the driving-point (d. p.) impedance at port 1 is $Z_{11}(s) = K_1 \frac{(s+2)}{(s+5)}$ the d. p. impedance at port 2 will be



a. $Z_{22}(s) = K_2 \frac{(s+3)}{(s+5)}$
b. $Z_{22}(s) = K_2 \frac{(s+2)}{(s+3)}$
c. $Z_{22}(s) = K_2 \frac{s}{(s+5)}$
d. $Z_{22}(s) = K_2 \frac{s}{(s+2)}$

53. The reactive power drawn from the source in the network shown in the given figure is



a. 300 VAR
b. 200 VAR
c. 100 VAR
d. zero

54. For a series RLC citcuit, the power factor at the lower half power frequency is
a. 0.5 lagging
b. 0.5 leading
c. unity
d. 0.707 leading

55. If a network has all linear elements except for a few nonlinear ones, then superimpositions theorem
a. cannot hold at all
b. always holds
c. may hold on careful selection of element values, source waveform and response
d. holds in case of direct current excitations

56. A system function has a single zero and single pole. The constant multiplier 'K' is 1. For the given excitation sin t, the response is 2 with 45° lagging. The system has a pole and a zero respectively at
a. zero and 1
b. infinity and -1
c. -1 and zero
d. zero and -1

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

List I
A. Sensitivity
B. Resolution
C. Accuracy
D. Precision

List II
1. Closeness to the true value.
2. A measure of reproducibility of the instrument
3. Ratio of response to the change in the input signal
4. Smallest change in input to which the instrument can respond

Codes;

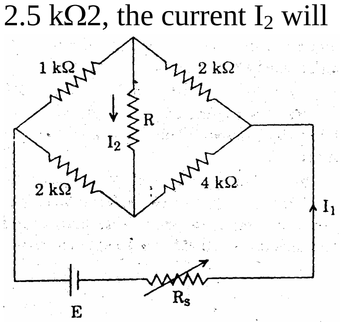
	A	B	C	D
a.	3	4	1	2
b.	3	4	2	1
c.	4	3	2	1
d.	4	3	1	2

58. In the SI system, the dimension of emf is
 a. $M L^{3} T^{-3} I$
 b. $M L^{3} T^{-3} I^{-1}$
 c. $M L^{2} T^{-3} I^{-1}$
 d. $M^{-1} L^{2} T^{3} I$

59. Which one of the following techniques is adopted to reduce the self-inductance of a wire-wound standard resistor?
 a. Bifilar winding
 b. Negative impedance converter
 c. Force balance type flux compensation
 d. Providing additional potential terminals

60. The voltage of a standard cell is monitored daily over a period of one year. The mean value of the voltage for every month shows a standard deviation of 0.1 mV. The standard deviation of the set constituted by the monthly mean values will be
 a. zero
 b. 0.1 / 12
 c. $0.1/\sqrt{12}$
 d. 0.1

61. A bridge is shown in the given figure. If the resistance R_s is increased from 2 kΩ to 2.5 kΩ2, the current I_2 will



 a. increase
 b. decrease
 c. not change
 d. increase or decrease depending on the polarity of E

62. A dc electronic voltmeter using chopper stabilization is free from errors due to
 a. low CMRR
 b. amplifier drift
 c. source output impedance
 d. interference

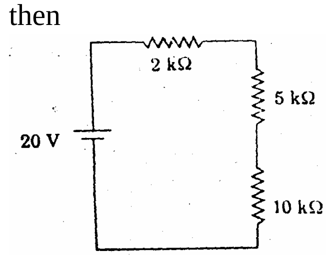
63. In a PMMC instrument, the central spring stiffness and the strength of the magnet decrease by 0.04% arid 0.02% respectively due to a rise in temperature by 1°C. With a rise in temperature of 10°C, the instrument reading will
 a. increase by 0.2%
 b. decrease by 0.2%
 c. increase by 0.6%
 d. decrease by 0.6%

64. When a current $i(t) = 5 + 10 \cos 314t$ is measured by an electrodynamics ammeter, the meter will read
 a. $\sqrt{5^2 + 10^2}$
 b. $\sqrt{5^2 + \left(\frac{10^2}{2}\right)}$
 c. $\sqrt{5^2 + \left(\frac{10}{2}\right)^2}$
 d. $\sqrt{\frac{5^2 + 10^2}{2}}$

65. Two equal voltages of same frequency applied to the X and Y plates of a CR0, produce a circle on the screen. The phase difference between the two voltages is
 a. 30°
 b. 60°
 c. 90°
 d. 150°

66. In a Q-meter, an inductor tunes to 2 MHz with 450 pF and to 4 MI-la with 90pF The distributed capacitance of the inductor is
 a. 30 pF
 b. 45 pF
 c. 90 pF
 d. 360 pF

67. Consider the network shown in the given figure. if a voltmeter of internal resistance 10 kΩ reads V_1 and V_2 respectively when connected stress 5 kΩ and 10 kΩ in turn, then



 a. $V_1 > V_2/2$
 b. $V_1 < V_2/2$
 c. $V_1 = V_2/2$

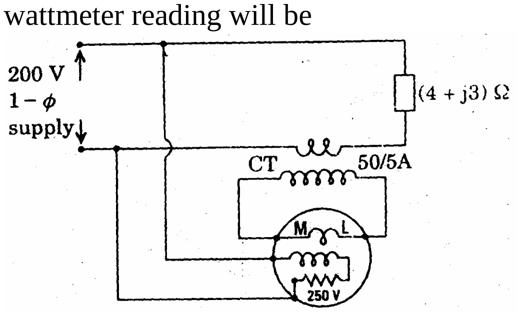
d. $V_1 = 6.67$ V

68. Consider the following statements:
A current transformer, is used for measurement of large currents to
1. Isolate the instrument from a hi9h voltage bus bar.
2. increase the accuracy of measurement
3. decrease the cost of measuring arrangements
4. extend the range of measurement of a conventional ammeter on ac

Which of these statements are correct?
a. 1 and 2
b. 2 and 3
c. 3 and 4
d. 1 and 4

69. If the readings of the two wattcmeters are equal and positive in two-wattmeter method, the load pf in a. balanced 3-phase 3- wire circuit will be
a. Zero
b. 0.5
c. 0.866
d. Unity

70. In the circuit shown in the given figure, the wattmeter reading will be



a. .480W
b. 640 W
c. 800 W
d. 1000 W

71. Consider the following statements is respect of a Wine bridge
1. It is suitable for measurement of capacitance
2. It is not affected by harmonics present in the applied voltage
3. It is suitable for measurement of frequency

Which of these statements are correct?
a. 1, 2 and 3
b. 1 and 2
c. 2 and 3
d. 1 and 3

72. The disc of a house service energy meter of 230 V, 1, ϕ, 50 Hz. 5 A, 2400 rev, per kWh creeps at 1 rev, per min. The creep error (in percent) of full load unity pf is

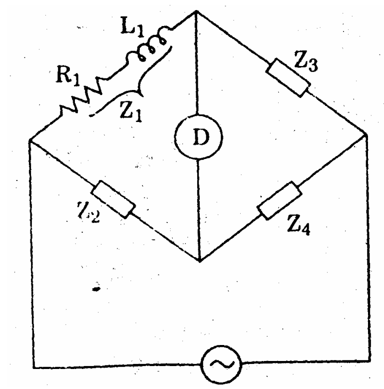
a. $+\frac{60}{2400}\times 100$

b. $-\frac{60}{2400}\times 100$

c. $+\frac{60}{1.15\times 2400}\times 100$

d. $-\frac{60}{1.15\times 2400}\times 100$

73. Consider the following statements regarding the balanced ac bridge shown in the given figure for measurement of a coil Z_1:



1. $Z_2 = R_2$ in series with L_2, $Z_3 = R_3$ and $Z_4 = R_4$.
2. $Z_2 = R_2$ $Z_3 = R_3$ and $Z_4 = R_4$ in parallel with L_4.
3. $Z_2 = R_2$, $Z_3 = R_3$ and $Z_4 = R_4$ in series with L_4
4. $Z_2 = R_2$ in parallel with L_2, $Z_3 = R_3$ and $Z_4 = R_4$.

Which of these statements are correct?
a. 1 and 4
b. 1 and 2
c. 2 and 3
d. 3 and 4

74. A symmetrical square wave voltage is read on an average response electronic voltmeter whose scale is calibrated in terms of rms value of a sinusoidal wave. The error in the reading is
a. -3.9%
b. + 3.9%
c. -11%
d. + 11%

75. The en½f is measured for a junction temperature difference of 20° C by thermocouples made from materials A, B

and C. The pair A - B gives an emf of 165µV, with the end of A being positive. The pair B - C gives 100 µV, with the end of C being positive. The pair A - C will give

a. 265 µV with the end of A being positive
b. 265 µV with the end of C being positive
c. 65 µV with the end of A being positive
d. 65 µV with the end of C being positive

76. Consider the following transducers:
1. L.V.D.T,
2. Piezoelectric
3. Thermocouple
4. Photovoltaic cell
5. Strain gauge

Which of these are active transducers?

a. 1, 2 and 5
b. 1, 3 and 4
c. 2, 3 and 5
d. 2, 3 and 4

77. Consider the fallowing ND converters used commonly in digital instruments:
1. Successive approximation type
2. Flash type
3. Dual slope type

The correct sequence in increasing order of their conversion times is

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

78. A fixed resistor of suitable value is usually connected across a thermistor to

a. decrease its resistance
b. increase its sensitivity
c. compensate its self-heating effect
d. improve linearity

79. Consider the systems shown in figure-I and figure-II. If the forward path gain is reduced by 10% in each system, then the variation in C_1 and C_2 will be respectively

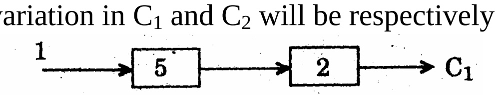


Figure I

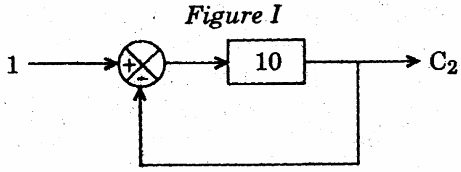


Figure II

a. 10% and 10%
b. 2% and 10%
c. 5% and 1%
d. 10% and 1%

80. The block diagrams shown in figure-I and figure-II are equivalent if 'X' (in figure-II) is equal to

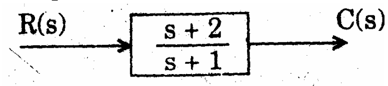


Figure I

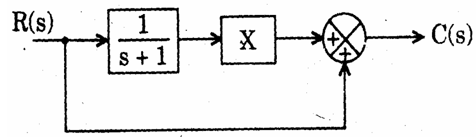
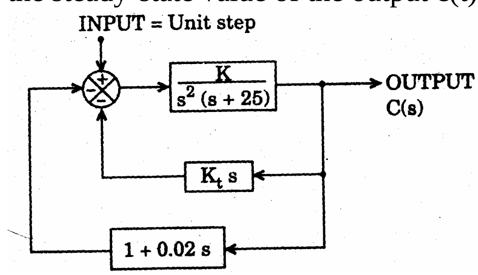


Figure II

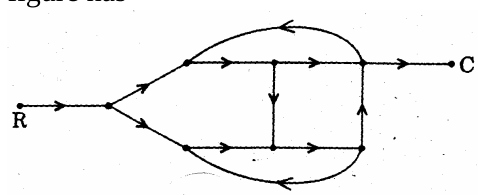
a. 1
b. 2
c. S + 1
d. S + 2

81. For the system shown in the given figure, the steady-state value of the output c(t) is



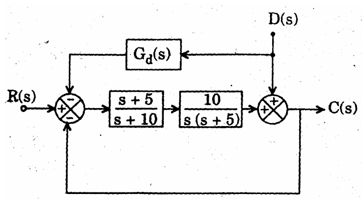
a. 0
b. 1
c. ∞
d. dependent on the values of K and K_t

82. The signal flow graph shown in the given figure has



a. three forward paths and two non-touching loops
b. three forward paths and three loops
c. two forward paths and two non-touching loops
d. two forward paths and three loops

83. In the system shown in the given figure, to eliminate the effect of disturbance D(s) on C(s), the transfer function $G_d(s)$ should be



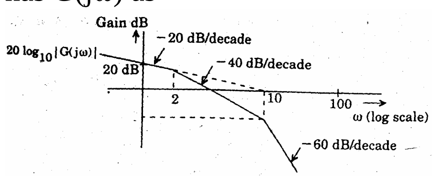
a. $\frac{(s+10)}{10}$

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

c. $\frac{10}{s+10}$

d. $\frac{10}{s(s+10)}$

84. The Bode plot shown in the given figure has G(jω) as



a. $\frac{100}{j\omega(1+j0.5\omega)(1+j0.1\omega)}$

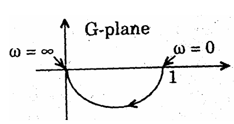
b. $\frac{100}{j\omega(2+j\omega)(10+j\omega)}$

c. $\frac{10}{j\omega(1+2j\omega)(1+10j\omega)}$

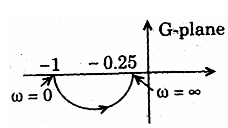
d. $\frac{10}{j\omega(1+0.5j\omega)(1+0.1j\omega)}$

85. The polar plot of $G(s)=\frac{1+s}{1+4s}$ for $0\le\omega\le\infty$ in G-plane is

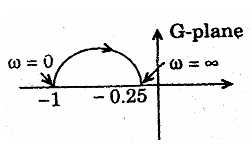
a.



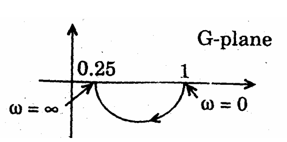
b.



c.



d.



86. The unit impulse response of a linear time-invariant second-order system is

$$g(t)=10e^{-8}\sin 6t\,(t\ge 0)$$

The natural frequency and the damping factor of the system are respectively

a. 10 rad/s and 0.6
b. 10 rad/s and 0.8
c. 6 rad/s and 0.6
d. 6 rad/s and 0.8

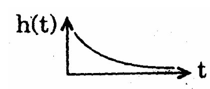
87. Match List I (Roots in the 's' plane) with list II (Impulse response) and select the correct answer:

List I

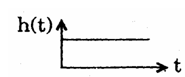
A. A single root at the origin
B. A single root on the negative real axis
C. Two imaginary roots
D. Two complex roots in the right half plane

List II

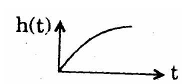
1.



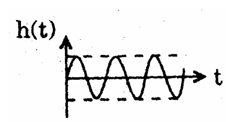
2.



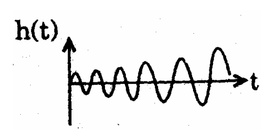
3.



4.



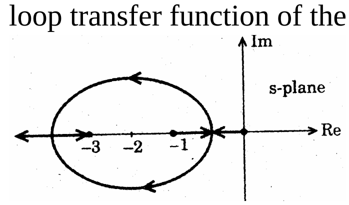
5.



Codes;

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

88. The root-locus of a unity feedback system is shown in the given figure. The open-loop transfer function of the system is



a. $\dfrac{K}{s(s+1)(s+3)}$

b. $\dfrac{K(s+1)}{s(s+3)}$

c. $\dfrac{K(s+3)}{s(s+1)}$

d. $\dfrac{Ks}{(s+1)(s+3)}$

89. Match List I with List II in respect of the open-loop transfer function

$$G(s)=\frac{K(s+10)(s^2+20s+500)}{s(s+20)(s+50)(s^2+4s+5)}$$ and

select the correct answer:

List I(Types of loci)
A. Separate loci
B. Loci on the real axis
C. Asymptotes
D. Breakaway points

List II (Numbers)
1. One
2. Two
3. Three
4. Five

Codes;

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

90. If the characteristic equation of a closed-loop system is

$$1+\frac{K}{s(s+1)(s+2)}=0$$

the centroid of the asymptotes in root-locus will be

a. Zero
b. 2
c. -1
d. -2

91. The open-loop transfer function of a unity feedback control system is $\dfrac{10}{(s+5)^3}$. The gain margin of the system will be

a. 20 dB
b. 40 dB
c. 60 dB
d. 80 dB

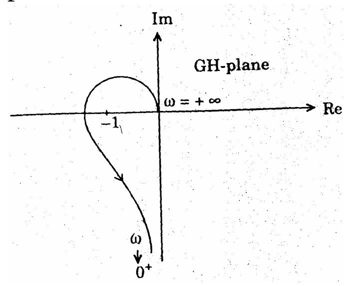
92. The characteristic equation of a feedback control system is

$s^3+Ks^2+5s+10=0$

For the system to be critically stable, the value of K should be

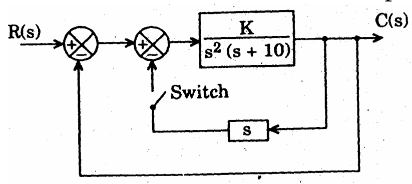
a. 1
b. 2
c. 3
d. 4

93. The Nyquist plot of the open-loop transfer function of a feedback control system is shown in the given figure. If the open-loop poles and zeros are all located in the left half of the s-plane, then the number of closed-loop poles in the tight half of the s-plane will be



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

94. The control system shown in the given figure has an internal rate feedback loop. The closed-loop system for open and close conditions of switch will be respectively



a. unstable and stable
b. unstable and unstable
c. stable and unstable
d. stable and stable

95. The transfer function of a lead compensator is

$$G_C(s)=\frac{1+0.12s}{1+0.04s}$$

The maximum phase shift that can be obtained from this compensator is -

a. 60°
b. 45°
c. 30°
d. 15°

96. A system is represented by

$\dddot{y} + 2\ddot{y} + 5\dot{y} + 6y = 5x$

If state variables are $x_1 = y$, $x_2 = y$ and $x_3 = \ddot{y}$, then the coefficient matrix 'A' will be

a. $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -5 & -2 \end{bmatrix}$

b. $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -5 & -6 \end{bmatrix}$

c. $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -6 & -5 & -2 \end{bmatrix}$

d. $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -2 & -5 & -6 \end{bmatrix}$

97. The state equation of a linear system is given by X = AX + BU, where

$$A = \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix} \text{ and } B = \begin{bmatrix} 0 \\ -1 \end{bmatrix}$$

The state transition matrix of the system is

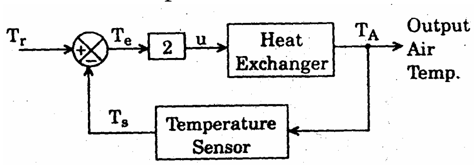
a. $\begin{bmatrix} e^{2t} & 0 \\ 0 & e^{2t} \end{bmatrix}$

b. $\begin{bmatrix} e^{-2t} & 0 \\ 0 & e^{2t} \end{bmatrix}$

c. $\begin{bmatrix} \sin 2t & \cos 2t \\ -\cos 2t & \sin 2t \end{bmatrix}$

d. $\begin{bmatrix} \cos 2t & \sin 2t \\ -\sin 2t & \cos 2t \end{bmatrix}$

98. The system shown in the given figure relates to tempera- hire control of air flow



Equation of heat exchanger is $10\dfrac{dT_A}{dt} + T_A = u$

Temperature sensor equation is $2\dfrac{dT_s}{dt} + T_s = T_A$

The closed-loop transfer function $\dfrac{T_A(s)}{T_R(s)}$ of the system is

a. $\dfrac{4s+2}{20s^2+12s+3}$

b. $\dfrac{4s+2}{20s^2+12s+1}$

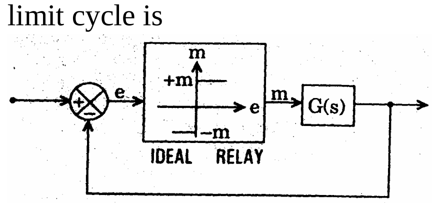
c. $\dfrac{2}{20s^2+12s+1}$

d. $\dfrac{2}{20s^2+12s+3}$

99. A non-linear control system is described by the equation θ + k sin θ = 0.The types of singular point at A = (0, 0) and B = (π, 0) will be respectively

a. centre and saddle
b. centre arid focus
c. focus and saddle
d. saddle and centre

100. A non-linear control system is shown in the figure. If the intercept of G(jω) on the negative real axis of G-plane is $(-\pi/2, +j0)$, then the amplitude of the limit cycle is



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

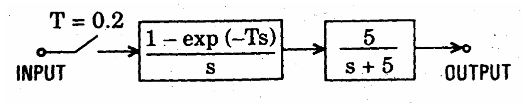
101. Consider the following statements regarding hold circuits for the reconstruction of sampled signals:

1. Hold circuits are essentially low pass filters.
2. A first order hold circuit introduces less phase lag in comparison to zero hold circuit.
3. A zero order hold has a flat gain-frequency over the frequency range of $0 \le \omega \le \dfrac{2\pi}{T}$. where T is the sampling period.

Which of these statements is/are correct?

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

102. The overall pulse transfer function of the system shown in the given figure is



a. $\dfrac{1-\exp(-1)}{Z-\exp(-1)}$

b. $\dfrac{Z\left[1+\exp(-1)\right]}{(Z-1)\left[Z+\exp(-1)\right]}$

c. $\dfrac{1+\exp(-1)}{Z+\exp(-1)}$

d. $\dfrac{Z\left[1-\exp(-1)\right]}{(Z-1)\left[Z-\exp(-1)\right]}$

103. For the volume charge density ρ_v the divergence of the electric field intensity will be equal to.

a. ρ_v / ε_0

b. $\varepsilon_0^2 \rho_v$

c. $\varepsilon_0 \rho_v$

d. ρ_v / ε_0^2

104. If the static magnetic flux density is B, then

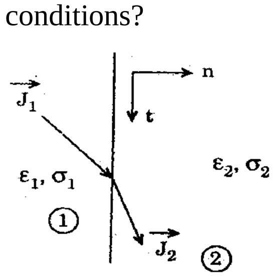
a. $\vec{\nabla} \times \vec{B} = 0$

b. $\vec{\nabla} . \vec{B} = \vec{0}$

c. $\vec{\nabla} \vec{B} = J$

d. $\vec{\nabla} \times \vec{B} = \vec{J}$

105. In the given figure, the normal and tangential components of the current density $\vec{J}$ at the interface of the boundary satisfy which one of the following sets of conditions?



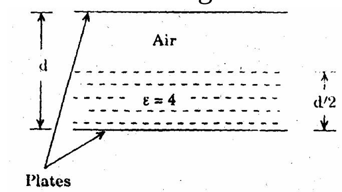
a. $\dfrac{Jn_1}{\sigma_1} = \dfrac{Jn_2}{\sigma_2}$ *and* $Jt_1 = Jt_2$

b. $\dfrac{Jn_1}{\sigma_1 \varepsilon_1} = \dfrac{Jn_2}{\sigma_1 \varepsilon_2}$ *and* $Jt_1 = Jt_2$

c. $Jn_1 = Jn_2$ *and* $\sigma_1 Jt_2$

d. $Jn_1 = \dfrac{\sigma_1}{\varepsilon_1} = \dfrac{Jn_2 \sigma_2}{\varepsilon_2}$ *and* $\dfrac{Jt_1}{\sigma_1} = \dfrac{Jt_2}{\sigma_2}$

106. A parallel plate capacitor of gap'd' with air as the dielectric can withstand a maximum voltage of 24 V. If the capacitor is half filled with a liquid of dielectric constant 4 as shown in the given figure, then the capacitor will withstand a maximum voltage of



a. 60V

b. 30V

c. 20V

d. 15V

107. An anisotropic dielectric is characterized by the permittivity tensor

$$\varepsilon = \varepsilon_0 \begin{matrix} 4 & 2 & 2 \\ 2 & 4 & 2 \\ 2 & 2 & 4 \end{matrix} \Bigg\}$$

For given $\vec{E} = 2\left(\vec{i}_x + \vec{i}_y + \vec{i}_z\right)$, the displacement density vector $\vec{D}$ will be

a. $2\varepsilon_0\left(4\vec{i}_x + 2\vec{i}_y + 2\vec{i}_z\right)$

b. $2\varepsilon_0\left(2\vec{i}_x + 4\vec{i}_y + 2\vec{i}_z\right)$

c. $2\varepsilon_0\left(2\vec{i}_x + 2\vec{i}_y + 4\vec{i}_z\right)$

d. $2\varepsilon_0\left(8\vec{i}_x + 8\vec{i}_y + 8\vec{i}_z\right)$

108. In a dielectric medium of relative permittivity 4, the electric field intensity is 20 sin (10^8 t - βz) $\vec{a}_y$ V/m and z being in m.

The phase shift constant β is

a. 1/3 rad/m

b. 2/3rad/rn

c. 2π /3 rad/m

d. 1 / 6π rad/m

109. Consider the following statements:

Transmission of a modulated signal in a communication system can take place by means of

1. coaxial cables
2. optical fibres.
3. open-wire transmission lines
4. waveguides

Which of these statements are correct?

a. 1, 2 and 3

b. 2, 3 and 4

c. 1 and 4

d. 1, 2, 3 and 4

110. The unit of the Pointing vector is

a. Power
b. power density
c. energy
d. energy density

111. The equation
$$\vec{E} = \vec{a}_x E \sin(\omega t - \beta z) + \vec{a}_y E \sin(\omega t - \beta z)$$
represents
a. a left circularly polarized wave
b. a right circularly polarized wave
c. a linearly polarized wave
d. an elliptically polarized wave

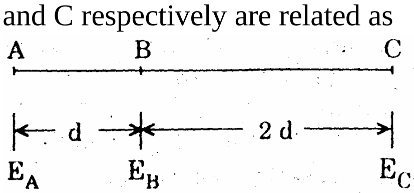
112. The intrinsic impedance of free space is
a. 377Ω
b. $\sqrt{\mu_0 \varepsilon_0}$
c. $j\sqrt{\mu_0 \varepsilon_0}$
d. ε_0 / μ_0

113. Consider the following pairs of types of energy transmission and practical lower frequency limit:
1. Transmission lines .... Zero
2. Optical fibres ... 300 MHz
3. Antennas.... 100 MHz

Which of these pair(s) is/are correctly matched?
a. 2 and 3
b. 1 and 2
c. 1 alone
d. 3 alone

114. If the electric field component of a wave is E = cos (6×10^8 πt + 50z) a_x V/m, then the wave
a. propagates in -x direction
b. amplitude is 2 V/m
c. is not traveling in free space
d. propagates in + z direction

115. A plane electromagnetic wave is travelling in a highly dissipative medium in the direction ABC as shown in the figure. The electric field E_A, E_B, and E_C at point A, B and C respectively are related as



a. $E_A^2 E_C = E_B^3$
b. $E_A E_B^2 = E_B^3$
c. $E_A E_C = E_B^2$
d. $E_A E_B = E_C^2$

116. Cavity resonators are used in
a. MF band
b. HF band
c. VHF band
d. SHF band

117. The reflection coefficient at the load end of a short-circuited line is
a. zero
b. $1\angle 0°$
c. $1\angle 90°$
d. $1\angle 180°$

118. The operator 'del' ∇ is a
a. vector space function
b. vector time function
c. scalar space function
d. scalar time function

119. The magnitude of the magnetic flux density 'B' at a distance 'R' from an infinitely long straight current filament is
a. $\dfrac{\mu_0 1}{2R}$
b. $\dfrac{\mu_0 1}{2\pi R}$
c. $\dfrac{\mu_0 1}{4\pi R}$
d. $\dfrac{\mu_0 1}{8\pi R^2}$

120. If a plane electromagnetic wave traveling in the direction $\vec{\beta} = \vec{a}_x \beta_x + \vec{a}_y \vec{\beta}_y + \vec{a}_z \beta_z$ has electric field $E = A\cos\left(\omega t - \vec{\beta}.\vec{r}\right)$, then the phase velocities $v_x : v_y : v_z$ is equal to
a. $\dfrac{1}{\beta_x^2} : \dfrac{1}{\beta_y^2} : \dfrac{1}{\beta_z^2}$
b. $\beta_x^2 : \beta_y^2 : \beta_z^2$
c. $\dfrac{1}{\beta_x} : \dfrac{1}{\beta_y} : \dfrac{1}{\beta_z}$
d. $\beta_x : \beta_y : \beta_z$