ELECTRICAL ENGINEERING

PAPER-I

1. Consider the following statements with reference to a system with velocity error constant $K_y = 1000$
   1. The system is stable.
   2. The system is of type 1
   3. The test signal used is a step input.

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

2. Which one of the following statements is NOT of correct?
   a. With the introduction of integral control, the steady state error increases
   b. The generalised error coefficients provide a simple way of determining the nature of the response of a feedback control to any arbitrary input
   c. The generalized error coefficients lead to calculation of complete steady state response without actually solving the system differential equation
   d. For a type-1 system, the steady state error for acceleration input is infinite

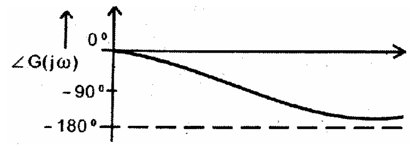
3. Consider the following statements with reference to the root loci of the characteristic equation of unity feedback control system with an open loop transfer function of

$$G(s) = \frac{K(s+1)(s+3)(s+5)}{s(s+2)}$$

   1. Each locus starts at an open loop pole and ends either at an open loop zero or infinity
   2. Each locus starts at an open loop pole or infinity and ends at an open loop zero.
   3. There are three separate root loci.
   4. There are five separate root loci.

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

4.



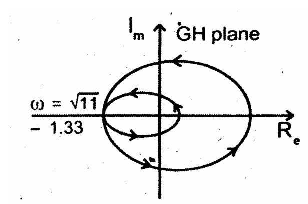
The Bodge phase angle plot of a system is shown above.
The type of the system is
   a. 0
   b. 1
   c. 2
   d. 3

5. The loop transfer function of a system is given by:

$$G(s) = \frac{K(s+10)^2(s+100)}{s(s+25)}$$

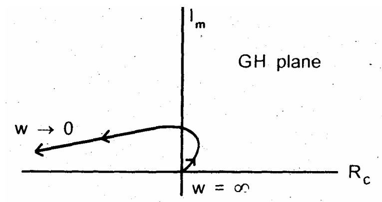
The number of loci terminating at infinity is
   a. 0
   b. 1
   c. 2
   d. 3

6.



The Nyquist plot of a unity feedback system having open $G(s) = \frac{K(s+3)(s+5)}{(s-2)(s-4)}$ loop transfer function for K = 1 is as shown above. For the system to be stable, the range of values of K is
   a. $0 < K < 1.33$
   b. $0 < K < 1/1.33$
   c. $K > 1.33$
   d. $K > 1/1.33$

7.



The Nyquist plot of a control system is shown above. For this system, G(s) H(s) is equal to

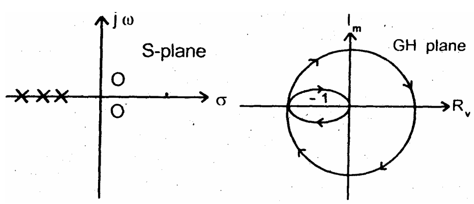
a. $\dfrac{K}{s(1+sT_1)}$

b. $\dfrac{K}{s^2(1+sT_1)}$

c. $\dfrac{K}{s^3(1+sT_1)}$

d. $\dfrac{K}{s^2(1+sT_1)s(1+sT_1)}$

8.



The pole-zero map and the Nyquist plot of the loop transfer function GH(s) of a feedback system are shown above. For this

a. Both open loop and closed loop system are stable
b. Open loop system is stable but closed loop system is unstable
c. Open loop system is unstable but closed loop system is stable
d. Both open loop and closed loop systems are unstable

9. A property of phase-lead compensation is that the

a. Overshoot is increased
b. Bandwidth of closed lop system is reduced
c. Rise-time of closed loop system is reduced
d. Gain margin is reduced

10. Which one of the following statements is NOT correct ?

a. The transfer function of a lag-lead compensation network is $\dfrac{(1+sT_1a)(1+sT_2b)}{(1+sT_1)(1+sT_2)}$ (a > 1, b < 1)
b. Bridged T-network is used for cancellation compensation
c. Phase-lag compensation improves steady state response and often results in reduced rise time
d. Compensating network can be introduced in the feedback path of a control system

11. Consider the following statements with respect to a system represented by its state-space model

X = AX + Bu and Y = CX

1. The static vector X of the system is unique.
2. The Eigen values of A are the poles of the system transfer function
3. The minimum number of state variables required is equal to the number of independent energy storage elements in the system.

Which of these statements are correct ?

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

12. The state-space representation of a system is given by

$$X = \begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U \text{ and } Y = \begin{bmatrix} 1 \\ 1 \end{bmatrix} X$$

Then the transfer function of the system is

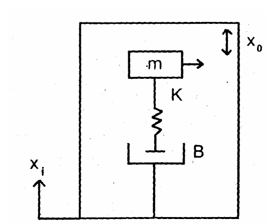
a. $\dfrac{1}{s^2+3s+2}$

b. $\dfrac{1}{s+2}$

c. $\dfrac{1}{s^2+3s+2}$

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

13.



A seismic transducer using a spring-mass-damper system as shown above will have an output displacement of zero when the input x_i is a

a. Constant displacement
b. Constant velocity
c. Constant acceleration

d. Sinusoidal displacement

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

List I (Component)

A. Input potentiometer in d.c. system
B. Synchro pair in a.c. system
C. Motor
D. Feedback tachogenerator

List II (Purpose)

1. Actuator
2. Error detector
3. Transducer

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

15. Which one of the following statements is NOT correct?

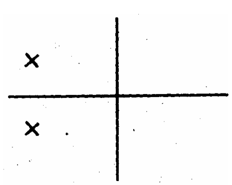
a. The action of bellows in pneumatic control system is similar to that of a spring
b. The flapper value converts large changes in the position of the flapper into small changes in the back pressure
c. The common name of pneumatic amplifier is pneumatic relay
d. The transfer function of a pneumatic actuator is of the form :

$$\frac{A}{Ms^2 + fs + K}$$

16. Match List I (Root Locations) with List II (Phase Plane Plots) and select the correct answer :

List I

A.



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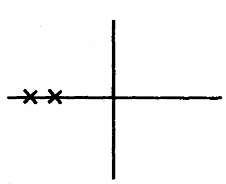

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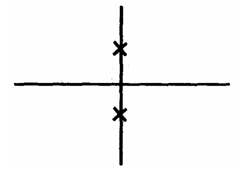
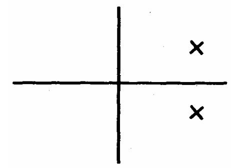
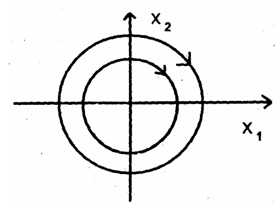


D.



List II

1.



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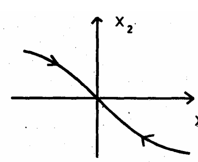

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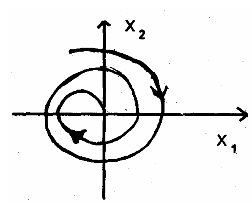

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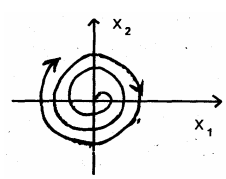


	A	B	C	D
a.	3	2	1	4
b.	2	3	4	1
c.	3	2	4	1
d.	2	3	1	4

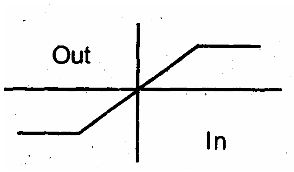
17. Match List I (Nonlinearity) with List II (Characteristics) and select the correct answer:

List I

A. Saturation
B. Idealstiction and Coulomb friction
C. Dead Zone
D. Relay with hysteresis

List II

1.



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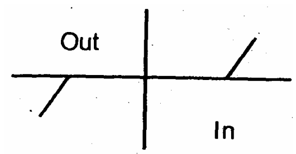

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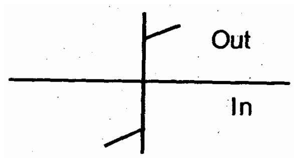

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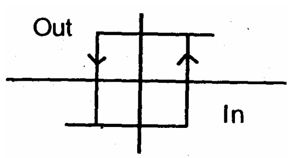


	A	B	C	D
a.	3	1	2	4
b.	1	3	2	4
c.	3	1	4	2
d.	1	3	4	2

18. Which one of the following methods is NOT used for the analysis of nonlinear control systems?
    a. Phase plane method
    b. Describing function method
    c. Liapunov's method
    d. Piecewise linear method

19. The transfer function of ZOH (Zero Order Hold) is
    a. $1-e^{Ts}$
    b. $1-e^{-Ts}$
    c. $\frac{1-e^{Ts}}{s}$
    d. $\frac{1-e^{-Ts}}{s}$

20. Consider the following statements:
    1. A discrete-time system is said to be stable if and only if its response of unit impulse δ(t) decays with k.
    2. Routh-Herwitz testing may be applied to determine the stability of discrete-data system using bilinear transformation $Z = \frac{1+\omega}{1-\omega}$
    3. A discrete data system is unstable if any of roots of the characteristic equation lies within the unit circle on the complex plane.

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

21. Assertion (A) : The test charge may have any value while defining electric field intensity.
    Reason (R) : The test charge should not disturb the field being measured.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually 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 scalar magnetic potential is evidently the quantity whose equipotential surfaces will form curvilinear squares with the stream lines of H.
    Reason (R) : The scalar magnetic potential satisfies Laplace's equation where J = 0.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually 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) : For steady current in an arbitrary conductor, the current density is solenoidal.
    Reason (R) : The reciprocal of the resistance is the conductivity.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually 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) : Displacement current can have only a.c. components.
    Reason (R) It is generated by a change in electric flux.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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) : A uniform plane wave is a transverse electromagnetic wave.
Reason (R) : A uniform plane wave can physically exist and represent finite energy.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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) : Energy released when an electron jumps from a higher to a lower level is usually in the form of photons.
Reason (R) : Energy released when an electron jumps from a higher to a lower level is absorbed by the nucleus.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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. Assertion (A) : Lepidolite type mica is un suitable for electric insulation.
Reason (R) : Lepidolite is hard and brittle.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

28. Assertion (A) : Glazing is done on ceramic insulators to make the surface smooth and non-absorbent.
Reason (R) : Moisture from the atmosphere can collect on the surface discontinuities on a ceramic and result in electrical breakdown.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

29. Assertion (A) : In a series R-L-C circuit, the current is a minimum at resonant frequency.
Reason (R) : The maximum voltage across the capacitor occurs at a frequency lower than the resonant frequency.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

30. Assertion (A) : A Schering Bridge used for testing of a porcelain insulator is shielded by a metallic screen.
Reason (R) : Earth's magnetic field is blocked by a metallic screen.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

31. Assertion (A) : Multiplexing of signals is in variably used in telemetry systems..
Reason (R) : Multiplexing improves signal to noise ratio over the communication channel and at destination.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

32. Assertion (A) Magnetic tape is not used for digital data recording directly.
Reason (R) : Digital data require high speed recording.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

33. Assertion (A) Stability of a system deteriorates when integral control is incorporated in it.
Reason (R) : With integral control order of the system increases, and higher the order of the system the more the system tends to become unstable.

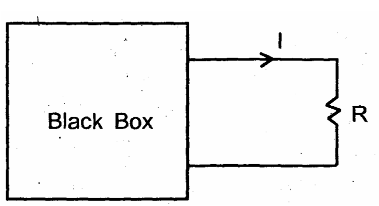
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

34. Assertion (A) : Use of lead compensation results in increased system bandwidth.
Reason (R) : The angular contribution of the compensator pole is more than that of the compensator zero.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

35. Assertion (A) : Tachogenerator feedback is used as minor loop feedback in position control systems to improve stability.
Reason (R) : Tachogenerator provides velocity feedback which decreases the damping in the system
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

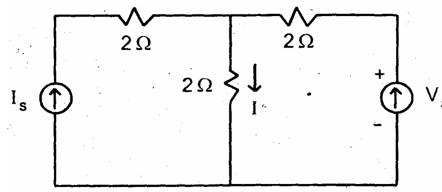
36. Assertion (A) : Servomotor normally have heavier rotors and lower RIX ratio as compared to ordinary motors of similar ratings.
Reason (R) : Servomotors should have smaller electrical and mechanical time constants for faster response.
a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually 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

37.



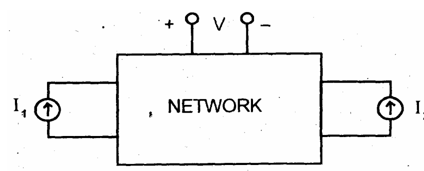
The black box as. shown in the circuit above contains resistors and independent sources. For R = 0 and 2, the value of current I is 3 and 1.5 respectively. The value of 1 for R = 1 will be
a. 0.5
b. 1.5
c. 2.0
d. 3.0

38.



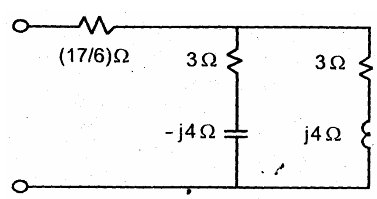
For the circuit shown above, the value of V_S is 0 when I = 4 A. The value of I when V = 16 V, is
a. 6 A
b. 8 A
c. 10 A
d. 12 A

39.



The linear network as shown above has only resistors. If I_1 8 A and I_2 = 12 A; V is found to be 80 V. V = 0 when I_1 = –8 A and I_2 = 4 A. Then the value of V when I_1 = I_2 = 10 A, is
a. 25 V
b. 50 V
c. 75 V
d. 100 V

40.



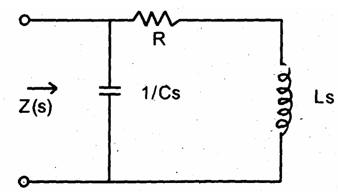
The total impedance of Z (jω) of the circuit shown above is
a. (6 + i0) Ω
b. (7 + j0) Ω
c. (0 + j8) Ω
d. (6 + j8) Ω

41. The impedance of a parallel RLC network is $Z(s)=\dfrac{5s}{s^2+0.5s+100}$. Then the value of R, L and C are, respectively

a. 10 Ω, 1/20 H, 1/5 F
b. 1 Ω, 1/2 H, 1/5 F
c. 10 Ω, 1/20 H, 1/2 F
d. 2 Ω, 1/20 H, 1/5 F

42. For a driving point impedance function $Z(s)=\frac{s+\alpha}{s+\beta}$ the voltage will lead the current sinusoidal input, iff
a. α and β real positive and α > β
b. α is real positive and β is real negative and α > β
c. α and β are real positive and β > α
d. α and β are real negative and β > α

43.



The impedance Z(s) in the above circuit is

a. $\frac{1}{C}\left(\frac{s+(R/L)}{s^2+(R/L)s+(1/LC)}\right)$

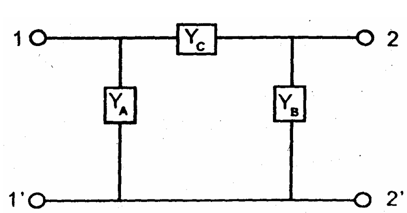
b. $\frac{1}{L}\left(\frac{s+(1/RC)}{s^2+(1/RC)s+(1/LC)}\right)$

c. $\frac{1}{L}\left(\frac{s+(R/L)}{s^2+(1/RC)s+(1/LC)}\right)$

d. $\frac{1}{C}\left(\frac{s+(1/RC)}{s^2+(R/L)s+(1/LC)}\right)$

44. A unit step current of 1 A is applied to a network whose driving point impedance is $Z(s)=\frac{V(s)}{1(s)}=\frac{s+3}{(s+2)^2}$.
Then the steady state and initial values of the voltage developed across the source are respectively
a. (3/4 V, 1 V)
b. (1/4 V, 3/4 V)
c. (3/4 V, 0 V)
d. (1 V, 3/4 V)

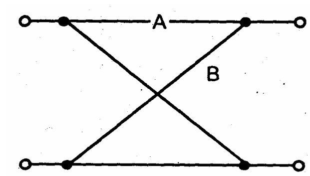
45.



For the two-port network as shown above, Y_{12} is equal to
a. $Y_A + Y_B$
b. $Y_C + \left(\frac{Y_A Y_B}{Y_A+Y_B}\right)$
c. $-Y_C$
d. Y_C

46. The driving point impedance function $Z(s)=\frac{s^2+2s+2}{s^2+s+1}$ can be realized as a
a. R-C network
b. R-L network
c. L-C network
d. R-L-C network

47.



The lattice circuit has the following impedances $Z_A = 3 + j4$, $Z_B = 3 - j4$. Then the Z-parameters would be

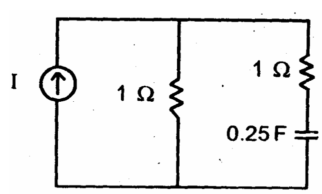
a. $\begin{pmatrix} 3+j4 & 0 \\ 0 & 3-j4 \end{pmatrix}$

b. $\begin{pmatrix} 3 & -j4 \\ -j4 & 3 \end{pmatrix}$

c. $\begin{pmatrix} 3+j4 & 3 \\ 3 & 3+j4 \end{pmatrix}$

d. $\begin{pmatrix} -j4 & 3 \\ 3 & +j4 \end{pmatrix}$

48.



In the circuit shown above, the initial voltage across capacitor is 2 V and I is a unit step current source. Then the voltage across the capacitor for t > 0 is
a. $(2-e^{-2t})\,u(t)$
b. $(2+e^{2t})\,u(t)$
c. $(1-e^{2t})\,u(t)$
d. $(1+e^{-2t})\,u(t)$

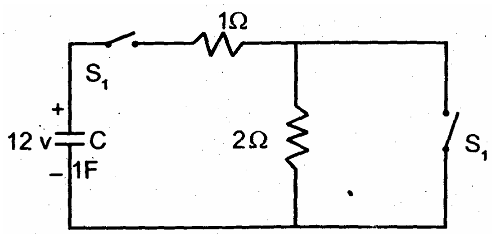
49. A circuit is modelled by the following differential equation :

$$\frac{d^2i(t)}{dt^2}+\frac{6di(t)}{dt}+9i(t)=0$$

The response i(t) is of the form (with symbols having their standard meanings)

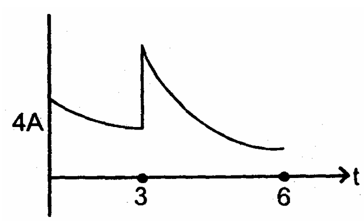
a. $K_1e^{-1} + K_2e^{-9t}$
b. $Ke^{-3t} \sin (t + \theta)$
c. $(K_1 + K_2t)\, e^{-3t}$
d. $Ke^{-t} . \sin (9t + \theta)$

50.

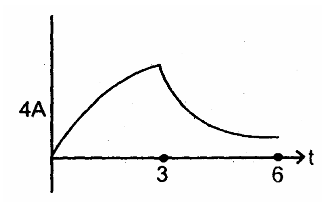


The capacitor in the circuit as shown above is initially charged to 12 V with S_1 and S_2 open S_1 is closed at t = 0 while S_2 is closed at t = 3. The waveform of the capacitor is represented by

a.



b.



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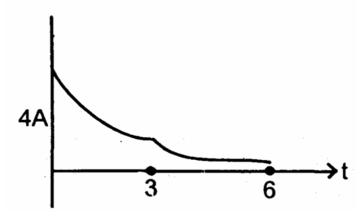

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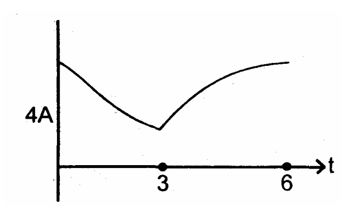


51. A 10 mH inductor carries a sinusoidal current of 1 A r.m.s. at a frequency of 50 Hz. The average power dissipated by the inductor is

a. 0 W
b. 0.25 W
c. 0.5 W
d. 1.0 W

52. An electromagnetic field is said to be conservative when

a. $\nabla^2 E = \mu \in (\partial^2 E / \partial t^2)$
b. $\nabla^2 H = \mu \in (\partial^2 H / \partial t^2)$
c. Curl of the field is zero
d. Divergence of the field is zero

53. A charge is uniformly distributed throughout the sphere of radius a. Taking the potential at infinity as zero, the potential at r = b < a is

a. $-\int_{\infty}^{b} \frac{Qr}{4\pi\varepsilon_0 a^3} dr$
b. $-\int_{\infty}^{b} \frac{Q}{4\pi\varepsilon_0 r^2} dr$
c. $-\int_{\infty}^{a} \frac{Q}{4\pi\varepsilon_0 r^2} dr - \int_{\infty}^{b} \frac{Qr}{4\pi\varepsilon_0 r^3} dr$
d. $-\int_{\infty}^{a} \frac{Q}{4\pi\varepsilon_0 r^2} dr$

54. Consider the following statements relating to Laplace's equation:

1. Solution of Laplace's equation with two different approved methods lead to different answers.
2. Every physical problem satisfying Laplace's equation must contain at least two conducting boundaries.
3. Every field (if $\rho_v = 0$) satisfies Laplace's equation.
4. Every conceivable configuration of electrodes or conductors produces a field for which $\nabla^2 v = 0$.

Which of these statements are correct ?

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

55. Which one of the following pairs is NOT correctly matched?

a. Gauss Theorem : $\oint_s \overline{D}.d\overline{s} = \oint_v \nabla.\overline{D}dv$
b. Gauss's Law : $\oint \overline{D}.d\overline{s} = \oint_v \rho dv$

c. Coulomb's Law : $V = -\frac{d\phi_m}{dt}$

d. Stoke's Theorem : $\oint_l \overline{\xi}.d\overline{l} = \oint_s \left(\nabla \times \overline{\xi}\right).d\overline{s}$

56. Which ones of the following formulae is NOT correct for the boundary between two magnetic materials?

a. $B_{n1} = B_{n2}$

b. $B_2 = \sqrt{B_{n2} + B_{t2}}$

c. $H_1 = H_{n1} + H_{11}$

d. $\hat{a}_{n21} \times \left(\overline{H}_1 - \overline{H}_2\right) = \overline{K}$, where $\hat{a}_{n21}$ is a unit vector normal to the interface and directed from region 2 to region 1

57. Interface of two regions of two magnetic materials is current-free. The region 1, for which relative permeability $\mu_{r1} = 2$ is defined by z > 0, and region 2, z > 0 has $\mu_{r2} = 1$.
If $B_1 = 1.2\ a_x + 0.8\ a_y + 0.4\ a_z$ T ; then H_1 is

a. $1/\mu_0\left[0.6\ \vec{a}_x + 0.4\ \vec{a}_y + 0.4\ \vec{a}_z\right]$A/m

b. $1/\mu_0\left[1.2\ \vec{a}_x + 0.8\ \vec{a}_y + 0.8\ \vec{a}_z\right]$A/m

c. $1/\mu_0\left[1.2\ \vec{a}_x + 0.4\ \vec{a}_y + 0.4\ \vec{a}_z\right]$A/m

d. $1/\mu_0\left[0.6\ \vec{a}_x + 0.4\ \vec{a}_y + 0.8\ \vec{a}_z\right]$A/m

58. A plane slab of dielectric having dielectric constant 5, placed normal to a uniform field with a flux density of 2 C/m^2, is uniformly polarized. The polarization of the slab is

a. 0.4 C/m^2

b. 1.6 C/m^2 V

c. 2.0 C/m^2

d. 6.4 C/m^2

59. Maxwell equation $\overline{\nabla} \times \overline{E} = -\left(\partial \overline{B} / \partial t\right)$ is represented in integral form as

a. $\oint \overline{E}.d\overline{l} = -\frac{\partial}{\partial t}\oint \overline{B}.d\overline{l}$

b. $\oint \overline{E}.d\overline{l} = -\frac{\partial}{\partial t}\oint_s \overline{B}.d\overline{s}$

c. $\oint \overline{E} \times d\overline{l} = -\frac{\partial}{\partial t}\oint_s \overline{B}.d\overline{l}$

d. $\oint \overline{E} \times d\overline{l} = -\frac{\partial}{\partial t}\oint_s \overline{B}.d\overline{l}$

60. Given that :

$\overline{H} = 0.5\exp\left[-0.1x\right]\sin(10^6 t - 2x)\hat{a}_z (A/m)$

which one of the following statements is NOT correct?

a. Wave is linearly polarized along $\hat{a}_z$

b. The velocity of the wave is 5 × 10^5 m/s

c. The complex propagation constant is (0.1 — j^2)

d. The wave is travelling along $\hat{a}_x$

61. For a conducting medium with conductivity σ, permeability μ and permittivity ε, the skin depth for an electromagnetic signal at an angular frequency ω is proportional to

a. σ

b. 1/ω

c. $1/\sqrt{\sigma}$

d. 1/μ

62. The electric field of a uniform plane wave is given by $E = 10\sin(10\omega t - \pi z)\hat{a}_x + 10\cos(\omega t - \pi z)\hat{a}_y$ (V/m)

The polarization of the wave is

a. Circular

b. Elliptical

c. Linear

d. Undefined

63. Consider the following statements:
Characteristic impedance of a transmission line is given by

1. $\sqrt{\frac{R + j\omega L}{G + j\omega C}}$, (R, L, G and C are line constants)

2. $\sqrt{Z_{OC} Z_{SC}}$, (Z_{OC} and Z_{SC} are the open and short circuit impedances of the line)

3. V'/I' , (V' and I' are the voltage and current of the wave travelling in the positive $\hat{y}$ direction)

Which of these are correct?

a. 1, 2 and 3

b. 1 and 2

c. 2 and 3

d. 1 and 3

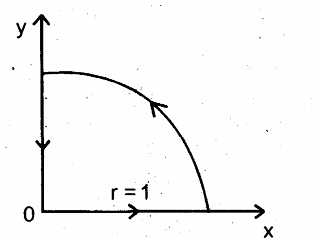
64. A loss-less transmission line of characteristic impedance Z_0 and $l < \lambda/4$ is

terminate at the load end by a short circuit. Its input impedance Z_S is

a. $Z_S = -j\ Z_0 \tan \beta l$
b. $Z_S = j\ Z_0 \cot \beta l$
c. $Z_S = j\ Z_0 \tan \beta l$
d. $Z_S = -j\ Z_0 \cot \beta l$

65. A loss-less transmission line of characteristic impedance 600 ohms is terminated in a purely resistive load of 900 ohms. The reflection coefficient is
a. 0.2
b. 0.5
c. 0.667
d. 1.5

66.



Given a vector field $\overline{A} = 2\ r \cos \phi\ T_r$ in coordinate. For the contour as shown above, $\oint \overline{A}.d\overline{l}$ is
a. 1
b. $1-(\pi/2)$
c. $1+(\pi/2)$
d. -1

67. The forbidden energy gap in silicon at 300 K is
a. 1.41 eV
b. 1.1 eV
c. 0.785 eV
d. 0.72 eV

68. With an increase in temperature., the Fermi level in an intrinsic semiconductor
a. Moves closer to the conduction band edge
b. Moves closer to the valence band edge
c. Moves into the conduction band
d. Remains at the centre of the forbidden gap

69. Which one of the following is NOT true for Sulphur Hexafluoride gas?
a. It is electronegative in nature
b. It has high dielectric strength
c. It is non-toxic
d. It is highly inflammable

70. Which one of the following materials has the highest dielectric strength?
a. Polystyrene
b. Marble
c. Cotton
d. Transformer oil

71. The losses in a dielectric subject to an alternating electric field are determined by
a. Real part ‘of the complex dielectric constant
b. Imaginary part of the complex dielectric constant
c. Absolute value of the complex dielectric constant
d. Ratio of the magnitudes of the real and imaginary parts of the complex dielectric constant

72. In a solid or liquid dielectric with externally applied electric field, as the interatomic distance increases the internal field E_i,
a. Increases
b. Decreases
c. Remains unaltered
d. Increases or decreases based on temperature

73. According to Wiedemann-Franz law the ratio of thermal conductivity to electrical conductivity of a conductor of
a. Independent of temperature
b. Directly proportional to temperature
c. Inversely proportional to temperature
d. Inversely proportional to square of temperature

74. Which one of the following statements is correct for four-point probe method of determining resistivity?
a. The sample must be extrinsic
b. The current source is connected to the two inner probes
c. One probe point must inject minority carriers
d. Current flow only in a small area of the sample

75. The average drift velocity V_d of electrons in a metal is related to electric field E and collision time T as
a. $V_d = Q_eET/m_e$
b. $V_d = m_eQ_eT$
c. $V_d = m_eQ_eT/2E$
d. $V_d = Q_eEt/2\ m_e$

76. Susceptibility of a diamagnetic material is
1. Negative
2. Positive

3. Dependent on the temperature
4. Independent of the temperature

Select the correct answer using the codes given below:

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

77. Match List I (Magnetic Materials) with List II (Applications) and select the correct answer:

List I

A. Silicon Steel
B. Ferrite
C. Alnico

List II

1. Current transformer
2. Power transformer
3. Permanent magnet
4. High frequency transformer

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

78. The development of barrier potential in the depletion zone of a PN junction is consequent to

a. Diffusion of majority carriers across junction
b. Drift of minority carriers across junction
c. Generation of minority carriers due to thermal energy
d. Initial flow of conduction current

79. The current flow in a certain PN junction at room temperature 300 K is 2×10^{-7} A when a large reverse bias voltage is applied. The current flowing when a forward bias of 0.1 V is applied will be

a. $2 \times 10^{-7} \exp\left[\dfrac{-1.6\times10^{-19}\times0.1}{1.38\times10^{-23}\times300}\right]$

b. $2 \times 10^{-7} \times\left[\dfrac{-1.6\times10^{-19}\times0.1}{1.38\times10^{-23}\times300}\right]$

c. $2 \times 10^{-7} \exp\left[\dfrac{-1.38\times10^{-23}\times300}{1.6\times10^{-19}\times0.1}\right]$

d. $2 \times 10^{-7} \times\left[\dfrac{1.38\times10^{-23}\times300}{1.6\times10^{-19}\times0.1}\right]$

80. On which of the following factors does the electrical conductivity of a semiconductor depend?

1. Carrier concentration
2. Carrier mobility
3. Sign of the carrier

Select the correct answer using the codes given below

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

81. An intrinsic semiconductor at a temperature of absolute zero behaves like an insulator because of

a. Non-availability of free electrons
b. Non-recombination of electrons with holes
c. Low drift velocity of free electrons
d. Low (almost zero) electron energy

82. Consider the following statements:

E_F^n and E_F^p are the energies of the Fermi levels on the n and p sides of p-n junction diode, respectively. They will vary with applied bias as follows :

1. E_F^n and E_F^p with no bias applied.
2. E_F^n increased and E_F^p decreases with forward bias.
3. E_F^n decreases and E_F^p increases with reverse bias.
4. E_F^n decreases and E_F^p increases with reverse bias.
5. E_F^n increases and E_F^p decreases with reverse bias.

Select the correct answer using the codes given below :

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

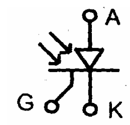
83. Match List I (Thyristors) with List II (Symbols) and select the correct answer :

List I

A. Silicon-controlled rectifier (SCR)
B. Silicon-controlled switch (SCS)
C. Silicon-unilateral switch (SUS)
D. Light-activated SCR (LASCR)

List II

1.



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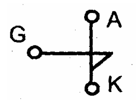

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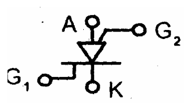

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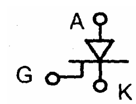
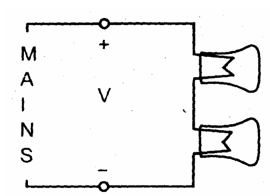


	A	B	C	D
a.	3	4	1	2
b.	4	3	1	2
c.	3	4	2	1
d.	4	3	2	1

84. In a network made up of linear resistors and ideal voltage sources, values of all resistors-are doubled. Then the voltage across each resistor is

a. Doubled
b. Halved
c. Decreases four times
d. Not changed

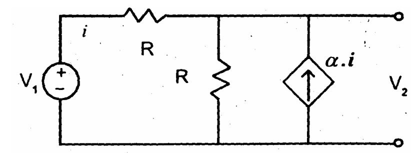
85.



The incandescent bulbs rated respectively as P_1 and P_2 operation at a specified mains voltage are connected in for series across the mains as shown in the above figure. Then the total power supplied by the mains to the two bulbs is

a. $\dfrac{P_1P_2}{P_1+P_2}$
b. $\sqrt{P_1^2+P_2^2}$
c. (P_1+P_2)
d. $\sqrt{P_1\times P_2}$

86.



Consider the circuit as shown above which has a current-dependent current source. The value V_2/V_1 is

a. 1
b. 2
c. $\dfrac{1+\alpha}{2+\alpha}$
d. $\dfrac{\alpha}{2+\alpha}$

87. A certain network consists of a large number of ideal linear resistances, one of which is designated as R and two constant ideal sources. The power consumed by R is P_1 when only the first source is active and P_2 when only the second source is active. If both sources are active simultaneously, then the power consumed by R is

a. $P_1 \pm P_2$
b. $\sqrt{P_1} \pm \sqrt{P_2}$
c. $\left(\sqrt{P_1} \pm \sqrt{P_2}\right)^2$
d. $(P_1 \pm P_2)^2$

88. Torque / Weight ratio of an instrument indicates

a. Selectivity
b. Accuracy
c. Fidelity
d. Sensitivity

89. Which of the following are data representation elements in a generalized measurement system ?

1. Analog indicator
2. Amplifier
3. A/D converter
4. Digital display

Select the correct answer using the codes given below:

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

90. A first order instrument is characterized by

a. Time constant only
b. Static sensitivity and time constant

c. Static sensitivity and damping coefficient
d. Static sensitivity, damping coefficient and natural frequency of oscillations

91. Wire-wound resistors are unsuitable for use at high frequencies because
a. They are likely to melt under excessive eddy current
b. They exhibit unwanted inductive and capacitive effects
c. They create more electrical noise
d. They consume more power

92. Decibel scale is useful while measuring voltages covering
a. Wide frequency ratio
b. Wide voltage ratio
c. Narrow frequency range
d. Narrow voltage range

93. A standard resistance is made 'Bifilar' type of eliminate
a. Stray capacitance
b. Temperature effect
c. Inductive effect
d. Skin effect

94. Standard cell
a. Will have precise and accurate constant voltage when current drawn from it is few microamperes only
b. Will have precise and accurate constant voltage when few milliamperes are drawn from it
c. Will continue to have constant voltage irrespective of loading conditions
d. Can supply voltages up to 10 V

95. For time and frequency, the working standard is
a. Microwave oscillator
b. Crystal controlled oscillator
c. Laser
d. Arf oscillator

96. A C.R.C. is operated with X and Y settings of 0.5 ms/cm and 100 mV/cm. The screen of the C.R.O. is 10 cm × 8 cm (X and Y). A sine wave of frequency 200 Hz and r.m.s. amplitude of 300 mV is applied to the Y-input. The screen will show
a. One cycle of the undistorted sine wave
b. Two cycles of the undistorted sine wave
c. One cycle of the sine wave with clipped amplitude
d. Two cycles of the sine wave with clipped amplitude

97. The difference between the indicated value and the true value of a quantity is
a. Gross error
b. Absolute error
c. Dynamic error
d. Relative error

98. Vibration galvanometers, tuneable amplifiers and head phones are used in
a. d.c. bridges
b. a.c. bridges
c. Both d.c. and a.c. bridges
d. Kelvin double bridge

99. A Wien-bridge is used to measure the frequency of the input signal. However, the input signal has 10% third harmonic distortion. Specifically the signal is 2 sin 400 πt + 0.2 sin 1200 πt (with t in sec.). With this input the balance will
a. Lead to a null indication and setting will correspond to a frequency of 200 Hz
b. Lead to a null indication and setting will correspond to 260 Hz
c. Lead to a null indication and setting will correspond to 400Hz
d. Not lead to null indication

100. Which one of the following multi-range voltmeters has high and constant input impedance ?
a. Permanent magnet moving coil voltmeter
b. Electronic voltmeter
c. Moving iron voltmeter
d. Dynamometer type voltmeter

101. In a Q-meter measurement to determine the self capacitance of a coil, the first resonance occurred at f_1 with C_1 = 300 pF. The second resonance occurred at $f_2 = 2f_1$ with C_2 = 60 pF. The self-capacitance of coil works out to be
a. 240 pF
b. 60 pF
c. 360 pF
d. 20 pF

102. A multimeter is used for the measurement of the following:
1. Both a.c. and d.c. voltage
2. Both a.c. & d.c. voltage
3. Resistance
4. Frequency

5. Power

Select the correct answer using the codes given below:

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

103. Which one of the following truly represents the output on the screen of spectrum analyzer when an amplitude modulated wave is connected to it?

a. Single vertical line on the screen
b. Two vertical lines on the screen
c. Three vertical lines with amplitude
d. Three vertical lines out of which two have equal magnitude

104. Three d.c. voltmeters are connected in series across a 120 V d.c. supply. The voltmeters are specified as follows:

Voltmeter A : 100 V, 5 mA
Voltmeter B : 100 V, 250 ohms/V
Voltmeter C : 10 mA, 15,000 ohms

The voltages read by the meters A, B and C are, respectively

a. 40, 50 and 30 V
b. 40, 40 and 40 V
c. 60, 30 and 30 V
d. 30, 60 and 30 V

105. The capacitance and loss angle of a given capacitor specimen are best measured by

a. Wheatstone bridge
b. Maxwell bridge
c. Anderson bridge
d. Schering bridge

106. The energy capacity of a storage battery is rated in

a. kwh
b. kw
c. Ampere hours
d. Joules

107. The pressure coil of an induction type energy meter is

a. Highly resistive
b. Highly inductive
c. Purely resistive
d. Purely inductive

108. Match List I (Parameter) with List II (Transducer) and select the correct answer:

List I

A. Pressure
B. Temperature
C. Displacement
D. Stress

List II

1. Thermistor
2. Piezoelectric crystal
3. Capacitance transducer
4. Resistance strain gauge
5. Ultrasonic waves

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

109. Measurement of flow, thermal conductivity and liquid level using thermistors make use of

a. Resistance decrease with temperature
b. Resistance increase with temperature
c. Self-heating phenomenon
d. Change of resistivity

110. Pair of active transducers is

a. Thermistor : Solar cell
b. Thermocouple; Thermistor
c. Thermocouple; Solar cell
d. Solar cell; LVDT

111. Sensitivity of LVDT is mainly due to

a. Magnetic shielding of the core
b. Permeability of the core
c. Exact cancellation of secondary voltages
d. Insulation used in the winding

112. A strain gauge with a resistance of 250 ohms undergoes a change of 0.150 ohm during a test. The strain is 1.5×10^{-4}. Then the gauge factor is

a. 2.0
b. 3.0
c. 4.0
d. 100 V

113. Integrating principle in the digital measurement is the conversion of

a. Voltage to time
b. Voltage to frequency
c. Voltage to current
d. Current to voltage

114. The correct sequence of the blocks is an analog data acquisition unit starting from the input is

a. Transducer - Recorder Signal - Conditioner

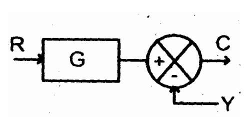
b. Transducer - Signal - Conditioner - Recorder
c. Signal - Conditioner - Transducer - Recorder
d. Signal - Conditioner - Recorder - Transducer

115. Which one of the following effects in the system is NOT caused by negative feedback?
a. Reduction in gain
b. Increase in bandwidth
c. Increase in distortion
d. Reduction in output impedance

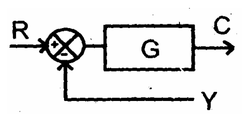
116. Match List I (Block Diagram) with List II (Transformed Block Diagram) and select the correct answer :

List I

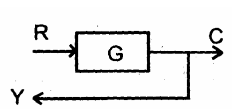
A.



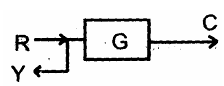
B.



C.

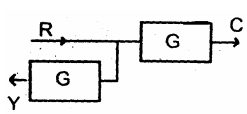


D.



List II

1.



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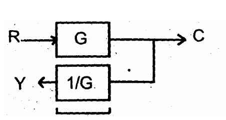

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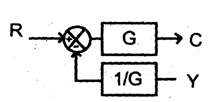

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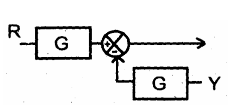
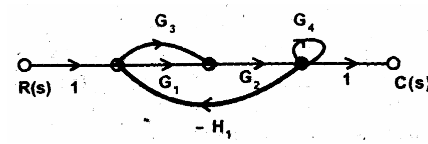


	A	B	C	D
a.	3	4	2	1
b.	4	3	1	2
c.	3	4	1	2
d.	4	3	2	1

117.



The gain C(s) / G(s) of the signal flow graph shown above is

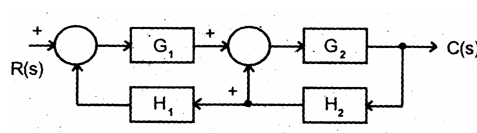
a. $\dfrac{G_1G_2+G_2G_3}{1+G_1G_2H+G_2G_3H_1+G_4}$

b. $\dfrac{G_1G_2+G_2G_3}{1+G_1G_2H_1+G_2G_3H_1-G_4}$

c. $\dfrac{G_1G_3+G_2G_3}{1+G_1G_3H_1+G_2G_3H_1+G_4}$

d. $\dfrac{G_1G_2+G_2G_3}{1+G_1G_3H_1+G_2G_3H_1-G_4}$

118.



The overall gain $\dfrac{C(s)}{R(s)}$ of the block diagram shown above is

a. $\dfrac{G_1G_2}{1-G_1G_2H_1H_2}$

b. $\dfrac{G_1G_2}{1-G_2H_2-G_1G_2H_1}$

c. $\dfrac{G_1G_2}{1-G_2H_2+G_1G_2H_1H_2}$

d. $\dfrac{G_1G_2}{1-G_1G_2H_1-G_1G_2H_2}$

119. The unit impulse response of a second order system is 1/6 $e^{-0.8t}$ sin (0.6 t). Then the natural frequency and damping ratio of the system. are respectively
a. 1 and 0.6
b. 1 and 0.8
c. 2 and 0.4
d. 2 and 0.3

120. A second order control system has

$$M(j\omega)=\frac{100}{100-\omega^2+10\sqrt{2}\,j\omega}$$

Its M_p (Peak magnitude) is
a. 0.5
b. 1
c. $\sqrt{2}$
d. 2