ELECTRICAL ENGINEERING

PAPER-I

1. For a line of characteristic impedance Z_0 terminated in a load of Z_R such that $Z_R = Z_0/3$, what is the reflection coefficient ΓL?
   a. 1/3
   b. —1/3
   c. 2/3
   d. —1/2

2. A transmission line has R, L, G, C distributed parameters per unit length of line. If γ is the propagation constant of the line, which one of the following expressions represents the characteristic impedance of the line?
   a. $\frac{\gamma}{R + j\omega L}$
   b. $\frac{R + j\omega L}{\gamma}$
   c. $\frac{G + j\omega C}{\gamma}$
   d. $\sqrt{\frac{G + j\omega C}{R + j\omega L}}$

3. Impedance inversion may be obtained with
   a. a short-circuited stub
   b. an open-circuited stub
   c. a quarter-wave line
   d. a half-wave line

4. When the temperature of a magnetic material is raised above the Curie point, it becomes
   a. diamagnetic
   b. paramagnetic
   c. ferromagnetic
   d. ferrimagnetic

5. Soft iron is used in the manufacture of electromagnets because of its
   a. high saturation magnetisation only
   b. low retentivity only
   c. low coercive field only
   d. high saturation magnetisation, low retentivity and low coercive field

6. With increase in temperature, magnetic susceptibility of a ferromagnetic material will
   a. increase
   b. decrease
   c. increase, initially and then decrease
   d. remain constant

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

   List-I
   A. No eddy current loss
   B. Small hysteresis loss
   C. Large hysteresis loss

   List - II
   1. Ferrimagnetic material
   2. Soft magnetic material
   3. Hard magnetic material
   4. Non-ferrous material

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

8. What is the packing fraction of a BCC (body-centered cubic) unit cell?
   a. $\frac{\sqrt{3}\pi}{16}$
   b. $\frac{\sqrt{3}\pi}{8}$
   c. $\frac{\sqrt{3}\pi}{12}$
   d. $\frac{\sqrt{2}\pi}{8}$

9. The relative dielectric constant of solid dielectrics in the alternating field is
   a. maximum at the power frequencies and decreases to unity at frequencies in the ultraviolet range
   b. maximum at the power frequencies and decreases to zero at frequencies in the ultraviolet range

c. unity at the power frequencies and increases to its maximum value at frequencies in the ultraviolet range
d. independent of frequency variations

10. Width of energy bands depends on which of the following?
a. Temperature
b. Pressure
c. Relative freedom of electrons in the crystal
d. Mass of atom in the material

11. Which one of the following statements is not true for a p-type semiconductor ?
a. Conduction is by the movement of holes in the valence band
b. Holes constitute the majority charge carriers
c. Fermi level lies closer to the conduction band between the conduction and valence bands
d. It is formed by adding an acceptor impurity to germanium

12. Principle of Hall effect is used in the construction of which one of the following?
a. Ammeter
b. Voltmeter
c. Galvanometer
d. Gaussmeter

13. For which one of the following materials, is the Hall coefficient zero ?
a. Metal
b. Insulator
c. Intrinsic semiconductor
d. Alloy

14. What is the magnetic susceptibility χ of an ideal superconductor ?
a. 1
b. –1
c. 0
d. Infinite

15. Assertion (A) : It is always desirable to take the reading of an indicating instrument very close to the full - scale reading.
Reason (R) : Accuracy of an indicating instrument is maximum at the full-scale deflection and error increases as reading comes closer to the beginning of the scale.
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

16. Assertion (A) : The rotating disc in an energy meter is made up of a magnetic material.
Reason (R) : Braking takes place due to eddy current generated by the braking magnet.
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

17. Assertion (A) : A p-type GaAs sample can be converted to a semi-insulating substrate by doping it with chromium.
Reason (R) : Chromium increases the band gap of GaAs.
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

18. Assertion (A) : DC servomotors are more commonly used in armature controlled mode instead of in field controlled mode.
Reason (R) : Armature controlled DC motors have higher starting torque than field controlled motors.
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

19. Assertion (A) : General purpose dynamometer type Wattmeter cannot indicate the correct value of power at low power factors.
Reason (R) : The presence of self-inductance in the pressure coil circuit introduces an error in the indicated value which increases appreciably with decrease in power factor.
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

20. Assertion (A) : With lag-lead compensation, the bandwidth of the system is not affected much.
Reason (R) : The effect of lag and lead compensations at high frequencies cancel one another.
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

21. Assertion (A) : For a stable feedback control system, the zeros of the characteristic equation must all be located in the left-half of the s-plane.
Reason (R) : The poles of the closed-loop transfer function are the zeros of the characteristic equation.
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

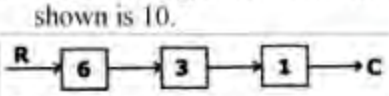
22. Assertion (A) : All the systems which exhibit overshoot in transient response will also exhibit resonance peak in frequency response.
Reason (R) : Large resonance peak in frequency response corresponds to a large overshoot in transient response.
a. Both A and R are individually true and R is the 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

23. Assertion (A) : Superconductivity of a superconducting material can be destroyed by application of an external magnetic field.
Reason (R) : If the applied magnetic field is greater than the critical magnetic field at a given temperature which is more than the transition temperature, superconductivity can be destroyed.
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. A rectifier instrument is used to measure an alternating square wave, of amplitude 100 V. What is the meter reading?
a. 100 V
b. 70.7 V
c. 111
d. None of the above

25. For defining the standard metre, wavelength of which material is considered?
a. Neon
b. Krypton
c. Helium
d. Xenon

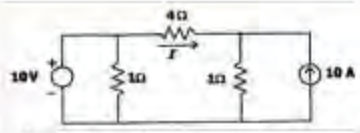
26. Consider the following statements in connection with feedback in control system:
1. With an increase in forward gain, the output value approaches the input value in the case of negative feedback closed-loop system.
2. A negative feedback closed loop system when subjected to an input of 5 V with forward gain of 1 and a feedback gain of 1 gives output 4.999 V.
3. The transfer function is dependent only upon its internal structure and components, and is independent of the input applied to the system.
4. The overall gain of the block diagram shown is 10.



Which of the statements given above are correct ?
a. Only 1 and 2
b. Only 2 and 3
c. Only 3 and 4
d. Only 1 and 3

27. For a discrete-time system to be stable, all the poles of the Z-transfer function should lie
a. within a circle of unit radius
b. outside the circle of unit radius
c. on left-half of Z-plane
d. on right-half of Z-plane

28.



In the network shown above, what is the current I in the direction shown ?

a. 0
b. 1/3 A
c. 5/6 A
d. 4 A

29. With increase in applied frequency, the dielectric loss, in a material will

a. increase
b. decrease
c. remain constant
d. become zero

30. Consider the network function :

$$H(s)=\frac{2(s+3)}{(s+2)(s+4)}$$

What is the steady-state response due to a unit step input?

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

31. What is the effect of phase lead compensator on gain crossover frequency (ω_{cg}) and on the bandwidth (ω_b) ?

a. Both are increased
b. ω_{cg} is increased but ω_b is decreased
c. ω_{cg} is decreased but ω_b is increased
d. Both are decreased

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

List-I

A. Bolometer
B. Hot-wire Anemometer
C. C-type Bourdon Tube
D. Optical Pyrometer

List-II

1. Measurement of temperature of a furnace
2. Measurement of high pressure
3. Measurement of flow of air around an aeroplane
4. Measurement of power at 500 MHz
5. Measurement of angular position

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

33. What is the range for a $3\frac{1}{2}$ digital meter?

a. 0 to 1999
b. 0 to 1500
c. 0 to 999
d. 0 to 19999

34.

Which one of the following is represented by the circuit shown above?

a. DeSauty bridge
b. Anderson bridge
c. Heaviside-Campbell bridge
d. Hay bridge

35. What should be the main characteristic(s) of the null detector in a bridge measurement?

1. Accuracy
2. Precision
3. Sensitivity
4. Resolution

Select the correct answer using the code given below :

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

36. A moving-coil instrument gives full- scale deflection for I mA and has a resistance of 5 Ω. If a resistance of 0.55 Ω is connected in parallel to the instrument, what is the maximum value of current it can measure?

a. 5 mA
b. 10 mA
c. 50 mA
d. 100 mA

37. A single slide wire is used for the measurement of current in a circuit. The voltage drop across a standard resistance of 1.0 Ω is balanced at 70 cm. What is the magnitude of the current, if the standard cell having an e.m.f. of 1.45 volts is balanced at 50 cm?

a. 3.09 A
b. 2.65 A
c. 2.03 A

d. 1.45 A

38. When reading is taken at half scale in the instrument, the error is
a. exactly equal to half of full-scale error
b. equal to full-scale error
c. less than full-scale error
d. more than full-scale error

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

List- I (Parameter to be measured)
A. Average value of current
B. QMS value of current
C. Frequency of a wave
D. Strain gauge resistance

List-H (Instrument to be used)
1. Self-balancing bridge
2. Wien bridge
3. PMMC ammeter
4. Moving-iron ammeter

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

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

List- I
A. Digital Counter
B. Schering Bridge
C. Megger
D. Spectrum Analyzer

List-II
1. Measurement of harmonics
2. Measurement of frequency
3. Measurement of dielectric loss
4. Measurement of insulation resistance

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

41. Which of the following factors limit the deflection of the pointer of a PMMC instrument to about 90°?
1. Its damping mechanism
2. Linearity of the magnetic field in which the coil moves
3. Control spring arrangement
4. Shape of the polo shoe of the horseshoe magnet

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

42. Which of the following indicating instruments has/have linear scale ?
1. Moving-iron meter
2. Permanent magnet moving-coil meter
3. Thermocouple meter
4. Rectifier type meter

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

43. A sinusoidal voltage of 1 V r.m.s. value at 10 Hz is applied across the two terminals of a PMMC type of voltmeter. What is the deflection of the pointer?
a. Zero volt
b. 1 volt
c. $\sqrt{2}$ volts
d. The pointer oscillates around zero volt

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

List- I (Instrument)
A. A. PMMC voltmeter
B. B. AC ammetor
C. C. Current transformer
D. D. Energy meter

List-II (Error)
1. Eddy current error
2. Phase angle error
3. Braking system error
4. Temperature error

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

45. Maxwell's inductance-capacitance bridge is used for measurement of inductance of
a. low Q coils only
b. medium Q coils only
c. high Q coils only

d. low and medium Q coils

46. Which one of the following statements **does not** state that electrostatic field is conservative?
   a. The curl of $\vec{E}$ is identically zero
   b. The potential. difference between two points is zero
   c. The electrostatic field is a gradient of a scalar potential
   d. The work done in a closed path inside the field is zero

47. In free space, if $\rho = 0$, the Poisson's equation becomes
   a. Maxwell's divergence equation $\nabla B=0$
   b. Laplacian equation $\nabla^2 V = 0$
   c. Kirchhoff's voltage equation $\Sigma V\ 0$
   d. None of the above

48. What is the magnetic field due to an infinite linear current carrying conductor?
   a. $H = \frac{\mu I}{2\pi r} A/m$
   b. $H = \frac{I}{2\pi r} A/m$
   c. $H = \frac{\mu I}{2r} A/m$
   d. $H = \frac{I}{r} A/m$

49. Equation $\nabla.\vec{B} = 0$ is based on
   a. Gauss's Law
   b. Lenz's Law
   c. Ampere's Law
   d. Continuity Equation

50. Sphere of radius a with a uniform charge density ρ_v C/m^3 shall have electric flux density at r = a, equal to
   a. $\frac{a}{3}\rho_v\ i.C/m^2$
   b. $\frac{1}{3}\rho_v\ i.C/m^3$
   c. $a\rho_v\ i.C/m^3$
   d. $\frac{a}{4}\rho_v\ i.C/m^2$

51. Which of the following is zero as applied to electromagnetic fields?
   a. grad div $\vec{A}$
   b. div grad V
   c. div curl $\vec{A}$
   d. curl curl $\vec{A}$

52. Image theory is applicable to problems involving
   a. electrostatic field only
   b. magnetostatic field only
   c. both electrostatic and magnetostatic fields
   d. neither electrostatic nor magnetostatic field

53. What is the force on a unit charge moving with velocity $\vec{v}$ in presence of electric field $\vec{E}$ and magnetic field $\vec{B}$?
   a. $\vec{E} - \vec{v}.\vec{B}$
   b. $\vec{E} + \vec{v}.\vec{B}$
   c. $\vec{E} + \vec{B} \times \vec{v}$
   d. $\vec{E} + \vec{v} \cdot \vec{B}$

54. Six capacitors of different capacitances C_1, C_2, C_3, C_4, C_5 and C_6 are connected in series. $C_1 > C_2 > C_3 > C_4 > C_5 > C_6$. What is the total capacitance almost equal to ?
   a. C_1
   b. C_2
   c. C_4
   d. C_6

55. Where is the Laplace's equation valid?
   a. Only in free space
   b. Only in conductors
   c. Only in charge free dielectric regions
   d. Only in cavities bounded on all sides by conducting walls

56. Plane y = 0 carries a uniform current density $30k$ mA/m. At (1, 20, —2) what is the magnetic field intensity?
   a. $-15i$ mA/m
   b. $15i$ mA/m
   c. $18.85j$ mA/m
   d. $25i$ mA/m

57. Equipotential surfaces about a pair of equal and opposite linear charges exist in what form?
   a. Concentric spheres
   b. Concentric cylinders
   c. Non-concentric cylinders
   d. Planes

58. What does the function f(x—v_0t) represent?
   a. A stationary wave
   b. A wave motion in a reverse direction

c. A wave motion in a forward direction
d. Not a travelling wave

59. The materials to be used in the manufacture of a standard resistance should be of
a. high resistivity and low temperature coefficient
b. low resistivity
c. high temperature coefficient
d. low resistivity and high temperature coefficient

60. What is the Poynting's vector on the surface of a long straight conductor of radius b and conductivity a which carries current I in the z-direction?
a. $-\frac{I^2}{2\sigma\pi^2 b^3} i_z$
b. $\frac{I^2}{2\sigma\pi^2 b^2} i_z$
c. $\frac{I^2}{\sigma\pi b^2} i_z$
d. $\frac{I}{2\pi b} i_\phi$

61. Match List -I with List-II and select the correct answer using the code given below the Lists

List - I (Material)
A. Fe
B. $MnOFe_2O_3$
C. $MgOFe_2O_3$
D. $NiOFe_2O_3$

List - II (Curie Temperature)
1. 783K
2. 523K
3. 863K
4. 1043K

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

62. Consider the following statements regarding EM wave:
1. An EM wave incident on a perfect dielectric is partially transmitted and partially reflected.
2. An EM wave incident on a perfect conductor is fully reflected.
3. When an EM wave is incident from a more dense medium to less dense medium at an angle equal to or exceeding the critical angle, the wave suffers total internal reflection.

Which of the statements given above are correct ?
a. Only 1 and 2
b. Only 2 and 3
c. Only 1 and 3
d. 1, 2 and 3

63. In an intrinsic semiconductor, the number of electrons is equal to the number of holes at which temperature ?
a. 0 K
b. 0°C
c. High temperature
d. All temperatures

64. Elements can reach a stable atomic structure by
a. losing electrons only
b. gaining electrons only
c. losin or gaining or sharing electrons
d. collisions between atoms

65. The values of radiative and non-radiative lifetime of minority carriers in a semiconductor are 50 ns and 100 ns, respectively. What is the effective lifetime?
a. 12.2 ns
b. 150 ns
c. 33.3 ns
d. 75 ns

66. Match List-I (Parameter) with List-II (Unit) and select the correct answer using the code given below the Lists :

List- I
A. Boltzman constant
B. Permeability of free space
C. Permittivity of free space
D. Mobility

List - II
1. farad/Metre
2. cm^2/volt – second
3. henry/metre
4. cm^2/second
5. electron volt/kelvin

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

67. III-V alloy semiconductor crystallizes in what form?

a. Simple cubic structure
b. Body-centered cubic structure
c. Zinc blende structure
d. Wurtzite structure

68. Match List-I (Term) with List-II (Concept) and select the correct answer using the code given below the Lists :

List-I

A. Norton equivalent of one port
B. Open-circuit output admittance
C. Reciprocal network
D. Transmission parameters

List-II

1. Network where loop and mode equations have a symmetric coefficient matrix
2. Hybrid parameter h_{22}
3. Parameters where V_1 and I_1 are expressed as functions of V_2 and $-I_2$
4. Current source in parallel with Thevenin impedance

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

69. A system function has a pole at s = 0 and a zero at S - –1. The constant multiplier is unity. For an excitation sin t, what is the steady-state response ?

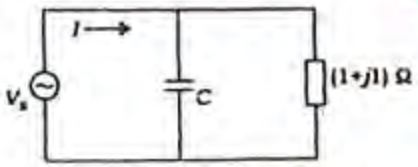
a. $\sqrt{2}\sin(t+45^{\circ})$
b. $\sqrt{2}\sin(t-45^{\circ})$
c. $\sin(t-45^{\circ})$
d. sin t

70. A system function $N(s)=\frac{V(s)}{I(s)}=\frac{s+3}{4s+5}$

The system is initially at rest. If the excitation i(t) is a unit step, which of the following are the initial and steady-state values of v(t)?

	Initial Value	Steady-state value
a.	0	3/5
b.	1/4	0
c.	3/5	1/4
d.	1/4	3/5

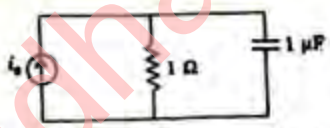
71.



In the circuit shown in the figure above, for what value of C will the current I be in phase with the sinusoidal source voltage $V_s = \sin 2t$?

a. $\frac{1}{4}F$
b. $\frac{1}{2}F$
c. $\frac{1}{\sqrt{2}}F$
d. 1 F

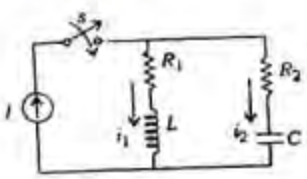
72.



In the circuit shown in the figure above, if $i_s = u(t)$ A, then what are the initial and steady-state voltages across the capacitor?

a. 1 V and 1 V, respectively
b. 1 V and 0, respectively
c. 0 and 1 V, respectively
d. 0 and 0, respectively

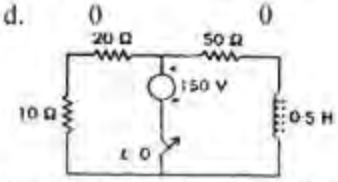
73.



In the circuit shown above, the constant current source of value I is switched on at t = 0. What are the values of currents i_1 and i_2 at t = 0, with zero initial conditions ?

	i_1	i_2
a.	I	0
b.	0	I
c.	$\frac{R_2}{R_1+R_2}I$	$\frac{R_2}{R_1+R_2}I$
d.	0	0

74.



In the circuit shown in the figure given above, the switch is opened at t = 0 after

having been closed for a long time. What is the current through 50 Ω resistor?

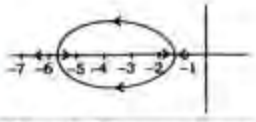
a. $3e^{-1/160\,t}$
b. $3e^{-1/100\,t}$
c. $3e^{-100\,t}$
d. $3e^{160\,t}$

75. Consider the following statements
The gain cross-over point is the point where
1. the magnitude $|G(j\omega)| = 1$ in polar plot
2. the magnitude curve of $G(j\omega)$ crosses zero dB line in Bode plot
3. magnitude vs phase plot touches the zero dB loci in Nichol's chart

Which of the statements given above are correct?

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

76.



What is the open-loop transfer function for a unity feedback having root locus shown in the above figure?

a. $\frac{k(s+5)}{(s+1)(s+2)}$
b. $\frac{k(s+1)}{(s+5)(s+6)}$
c. $\frac{k}{s(s+1)(s+5)}$
d. $\frac{k(s+2)}{(s+1)(s+5)}$

77. The transfer function of a phase lead compensator is found to be of the form $\frac{s+z_1}{s+p_1}$ and that of a lag compensator to be of the form $\frac{s+z_2}{s+p_2}$
Then which of the following conditions must be satisfied?

a. $z_1 > p_1$ and $z_2 > p_2$
b. $z_1 > p_1$ and $z_2 < p_2$
c. $z_1 < p_1$ and $z_2 < p_2$
d. $z_1 < p_1$ and $z_2 > p_2$

78. Given

$$[\dot{X}] = \begin{bmatrix} 0 & 1 \\ -1 & 1 \end{bmatrix}[x] + \begin{bmatrix} 0 \\ k \end{bmatrix} u$$

$y = x_1 + x_2$

$$[X] = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

What is the transfer y/x ?

a. $\frac{k(s+2)}{s^3+2s^2+s+1}$
b. $\frac{k(s+2)}{s^2+s+1}$
c. $\frac{ks}{s^2+2s+1}$
d. $\frac{k}{s^2+s+1}$

79. An electromechanical closed-loop control system has the transfer function

$$\frac{C(s)}{R(s)} \quad \frac{k}{s(s^2+s+1)(s+4)+k}$$

Which one of the following is correct?

a. The system is stable for all positive values of k
b. The system is unstable for all values of k
c. The system is stable for values of k between zero and 3.36
d. The system is stable for values of k between 1.6 and 2.45.

80. A particular control system yielded a steady-state error of 0.20 for unit step input. A unit integrator is cascaded to this system and unit ramp input is applied to this modified system. What is the value of steady-state error for this modified system?

a. 0.10
b. 0.15
c. 0.20
d. 0.25

81. In order to recover the original signal from the sampled one, what is the condition to be satisfied for sampling frequency ω_s and highest frequency component ω_m ?

a. $\omega_m < \omega_s \le 2\omega_m$
b. $\omega_s \ge 2\omega_m$
c. $\omega_s < \omega_m$
d. $\omega_s = \omega_m$

82. The characteristic equation of second-order sampled date system is given by $F(z) = a_2z^2 + a_1z + a0 = 0$. $a_2 > 0$.

What are the stability constraints for this system ?

1. $a_2 + a_1 + a_0 > 0$
2. $a_2 - a_1 + a_0 > 0$
3. $|a_0| < a_2$
4. $|a_0| > a_2$
5. $(a_0) < a_2$

Select the correct answer using the code given below :

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

83. Consider the following statements :

1. For a linear discrete system to be stable, all the roots of the characteristic equation 1 + GH(z) = 0 should be inside the unit circle.
2. The Bode diagram of a sampled data system can be constructed using bilinear transformation.
3. The root locus technique can be used for sampled data system without requiring any modifications.

Which of the statements given above is/are correct ?

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

84. Match List-I (Nature of Eigen value) with List-II (Nature of Singular Point) and select the correct answer using the code given below the Lists:

List-I

A. Real, negative and distinct
B. Real, equal but opposite in sign
C. Purely imaginary pair
D. Complex conjugate pair

List-II

1. Centre
2. Focus point
3. Saddle point
4. Stable node
5. Unstable node

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

85. Which one of the following statements is not related to limit cycles (phenomena) found in non-linear systems?

a. They are oscillations of fixed amplitude and period
b. They are undesirable. However, they can be tolerated if magnitude is within desirable limit
c. They are independent of initial conditions
d. Slight change in parameter, destroys the oscillation

86. The effect of tachometer feedback in a control system is to reduce

a. only time constant
b. only gain
c. damping
d. both gain and time constant

87. Match List-I (Application) with List-II (Control System Component) and select the correct answer using the code given below the Lists :

List-I

A. Measuring inclination of frames in inertial navigation system
B. Used as an actuator element in computer printer
C. For low power applications

List- II

1. Gyroscope
2. Servometer
3. Stepper Motor
4. Schrage Motor

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

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

List-I

A. Synchros
B. Operational amplifier
C. Stepper motor
D. Tacho-generator

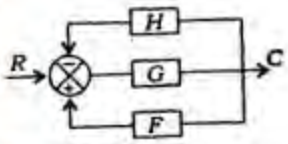
List-II

1. Controller
2. Error detector
3. Actuator
4. Feedback element

	A	B	C	D

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

89.



For the feedback system shown in the figure above, which one of the following expresses the input-output relation C/R of the overall system

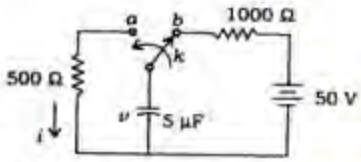
a. $\frac{G}{1-FG+GH}$

b. $\frac{G}{1+FG-GH}$

c. $\frac{FG}{1+FGH}$

d. $\frac{GH}{1-FGH}$

90.



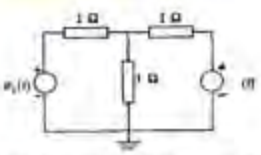
At t = 0, the switch k is thrown from b to a of the circuit as shown above. What are the values of $v(0^-)$ and $i(0^+)$?

a. 50 V,90 mA
b. 50 V, 100 mA
c. 50 V, 110 mA
d. 50 V, 120 mA

91. An R-C series circuit, initially at rest has a step voltage signal. The response v(t) across C is $v(t) = 1 - e^{-3t}$. If now there is an initial voltage at C of 3 volts, what is v(t) for the same step signal?

a. $1 + 3e^{-3t}$
b. $1 + 2e^{-3t}$
c. $3e^{-3t}$
d. None of the above

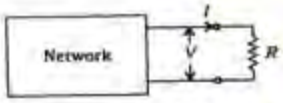
92.



In the circuit shown in the above figure, $e_1(t) = \sqrt{3}\cos(\omega t + 30°)$ and $e_2(t) = \sqrt{3}/\sin(\omega t + 60°)$. What is the voltage v(t) across the 1Ω grounded resistor ?

a. $\{\cos \omega t\}$V
b. $\{\sin(\omega t + 30^0) + \cos(\omega t + 60°)\}$V
c. $\{1\angle 90°\}$V
d. $\{j\ 1\}$V

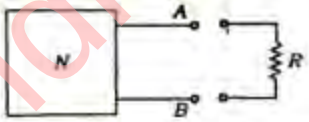
93.



For the network shown as above, when I = 0, V = 20 V and when R = 0,I = 10A. If now R = 3 Ω, what is the value of the current I ?

a. 6.67 A
b. 6.0 A
c. 4.0 A
d. 10 A

94.



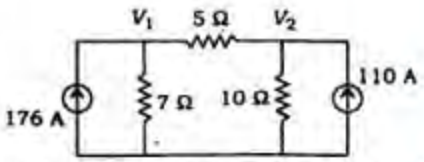
Norton equivalent to the network N to the left of AB is a cu rent source $I_N = 4$ A from B to A, $R_N = 2\Omega$. The current through R when it is connected across AB = 2A. What is the value of resistance R?

a. 1Ω
b. 2Ω
c. 3Ω
d. 4Ω

95. In a series R-L-C circuit, the maximum voltage across the capacitor occurs at a frequency

a. double the resonant frequency
b. equal to resonant frequency
c. $\sqrt{2}$ times the resonant frequency
d. below the resonant frequency

96.



In the circuit shown above, what is the voltage across 5 Ω resistor ?

a. —30V
b. 30V
c. 1250 V
d. —1250 V

97. Consider the following network functions :

1. $\frac{(s^2+1)(s^2+4)}{(s^2+3)(s^2+9)}$
2. $\frac{(s^2+1)(s^2+9)}{s(s^2+4)}$
3. $\frac{s(s^2+9)}{(s^2+1)(s^2+4)}$
4. $\frac{s(s^2+4)}{(s^2+1)}$

Which of the above functions can represent L-C driving-point immittances ?

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

98. A series R-L-C circuit excited by a 100 V, variable frequency source, has a resistance of 10 Ω and an inductive reactance of 50Ω at 100 Hz. If the resonance frequency is 500 Hz, what is the voltage across the capacitor at resonance?

a. 100 V
b. 500V
c. 2500V
d. 5000 V

99. What is the transfer function of a system whose impulse response is $e^{-3t}\sin 2t$?

a. $\frac{13}{s^2+6s+13}$
b. $\frac{1}{s^2+6s+13}$
c. $\frac{2}{s^2+6s+13}$
d. $\frac{5}{s^2+6s+13}$

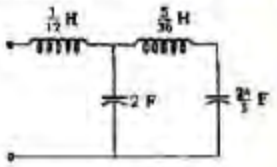
100. Consider the following statements in connection with the properties of R-C impedance functions:

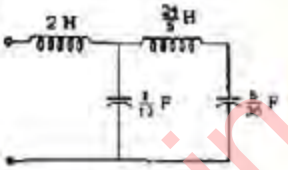
1. All the poles and zeros are simple.
2. Poles and zeros interlace.
3. Poles and zeros are located on the negative real axis of the s-plane.

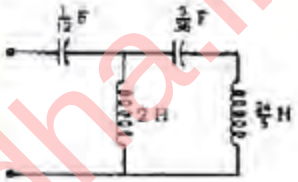
Which of the statements given above are correct?

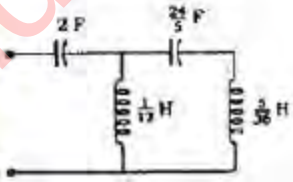
a. 1, 2 and 3
b. Only 1 and 2
c. Only 2 and 3
d. Only 1 and 3

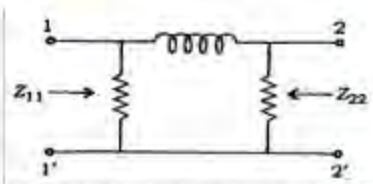
101. $Z(s)=\frac{2(s^2+1)(s^2+9)}{s(s^2+4)}$ may be synthesized into Cauer first form as

a. 

b. 

c. 

d. 

102. 

If the driving-point impedance Z_{11} of the network shown in the figure above is given by $Z_{11}=k_1\left(\frac{s+3}{s+8}\right)$ then what is the driving-point impedance Z_{22} ?

a. $k_2\left(\frac{s+5}{s+3}\right)$
b. $k_2\left(\frac{s+5}{s+8}\right)$
c. $k_2\left(\frac{s+3}{s+5}\right)$
d. $k_2\left(\frac{s+8}{s+5}\right)$

(k_1 and k_2 are scale factors)

103. What is the series resistance required to extend the 0-100 V range of a 20000 Ω/V meter to 0-1000 V?

a. 10 MΩ
b. 16 MΩ
c. 18 MΩ
d. 20 MΩ

104. The voltage coil of a single-phase house service energy meter
a. is highly resistive
b. is highly inductive
c. is highly capacitive
d. has a phase angle equal to load power factor angle

105. Which of the following can be used/modified for measurement of angular speed?
1. LVDT
2. Magnetic pick-up
3. Tacho-generator
4. Strain gauge
Select the correct answer using the code given below:
a. Only 1 and 2
b. Only 2 and 3
c. Only 3
d. Only 2, 3 and 4

106. Piezo-electric crystal is generally employed for the measurement of which one of the following?
a. Flow
b. Velocity
c. Acceleration
d. Temperature

107. In microwave telemetry, repeater stations are required at every
a. 2 km
b. 5 km
c. 40 km
d. 100 km

108. Data acquisition systems are usually of
a. analog type
b. digital type
c. integrating type
d. hybrid type

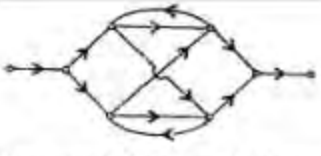
109. A successive approximation A/D converter has a resolution of 20 mV. What is its digital output for an analog input of 2.17 V ?
a. 01101100
b. 01101101
c. 0110101
d. 01110100

110. A doctor is using a digital clinical thermometer, which employs an A/D converter. The converter provides for both ±ve and —ve reference inputs in place of only +ve and ground potential reference inputs. $V_{ref}^{+} = 2.16$ V and $V_{ref}^{-} = 1.85$ V. The amplifier used for the converter input generates signal of 20 mV per °F of body temperature. The converter output is between 00000 and 11111. Which one of the following is correct?
a. The thermometer range is 9.25 °F to 108 °F
b. The thermometer range is 46 °F to 216 °F
c. The thermometer range is 0°F to 108 °F
d. The thermometer cannot be used to measure body temperature 98.4°F

111. Which one of the following bridges can be used to construct a harmonic distortion analyzer?
1. Maxwell bridge
2. Hay bridge
3. Schering bridge
4. Wien bridge
Select the correct answer using the code given below :
a. Only 1 and 2
b. Only 2 and 3
c. Only 3 and 4
d. Only 4

112. One cycle of a square wave signal observed on an oscilloscope is found to occupy 6 cm at a scale setting of 30μs/cm. What is the signal frequency?
a. 1.8 kHz
b. 5.55 kHz
c. 18 kHz
d. 55.5 kHz

113.

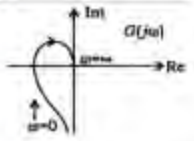


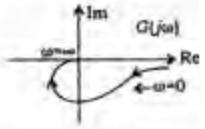
The signal flow graph shown above has M number of forward paths and P number of individual loops. What are their values?
a. M = 4 and P = 2
b. M = 6 and P = 3
c. M = 4 and P = 3

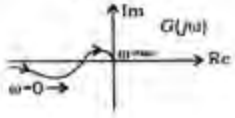
d. M = 6 and P = 2

114. Match List-I (Polar Plot of System) with List-II (System Type) and select the correct answer using the code given below the Lists :

List I

A. 

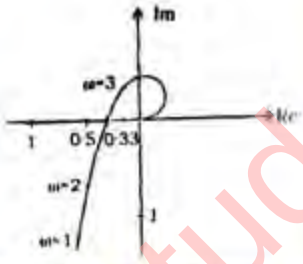
B. 

C. 

List-II

1. Type 0
2. Type 1
3. Type 2

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

115. 

What is the approximate value of the gain margin in the Nyquist diagram given above?

a. 0.67
b. 3.0
c. 1.0
d. 1/3

116. A second-order control system has a transfer function

$$\frac{C(s)}{R(s)} = \frac{\omega_n^2}{s^2 + 2\delta\omega_n s - \omega_n^2}$$

For unit step input, match List - I with List- II and select the correct answer using the code given below the Lists

List- I (Time Domain Specification)

A. Rise time
B. Peak time
C. Peak overshoot.
D. Settling time.

List -II (Expression)

1. $\dfrac{\pi - \tan^{-1}\left(\dfrac{\sqrt{1-\delta^2}}{\delta}\right)}{\omega_n\sqrt{1-\delta^2}}$
2. $\dfrac{\pi}{\omega_n\sqrt{1-\delta^2}}$
3. $e^{\left(-\pi\delta/\sqrt{1-\delta^2}\right)}$
4. $\dfrac{4}{\delta\omega_n}$

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

117. Consider the following statements in connection with the addition of a pole to the forward path transfer function :

1. Closed-loop system becomes less stable.
2. Rise time of the system increases.
3. Bandwidth of the system increases.

Which of the statements given above are correct?

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

118. The open-loop transfer function for unity feedback system is given by

$$\frac{5(1+0.1s)}{s(1+5s)(1+20s)}$$

Consider the following statements

1. The steady-state error for a step input of magnitude 10 is equal to zero.
2. The steady-state error for a ramp input of magnitude 10 is 2.
3. The steady-state error for an acceleration input of magnitude 10 is infinite.

Which of the statements given above are correct?

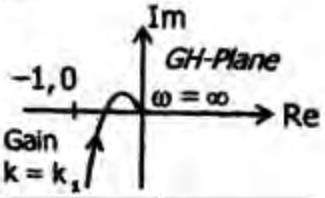
a. Only 1 and 2
b. Only 1 and 3
c. Only 2 and 3

d. 1, 2 and 3

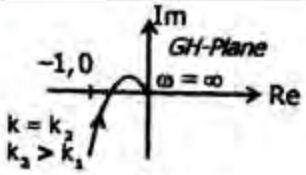
119. Match List-I (Nyquist Plot) with List-II (Frequency Response) and select the correct answer using the code given below:

List I

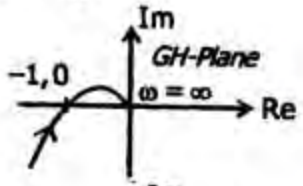
A.



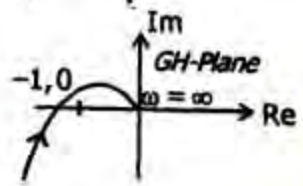
B.



C.

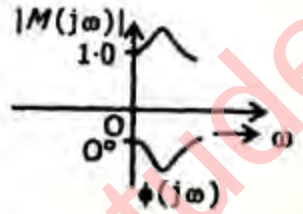


D.

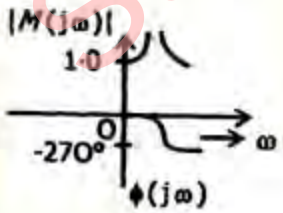


List-II

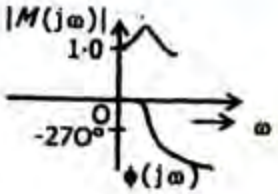
1.



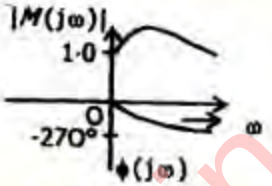
2.



3.

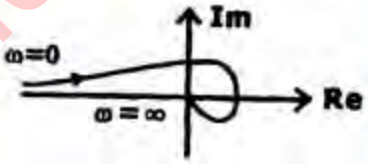


4.



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

120. The Nyquist plot of a system is sketched below :



Corresponding to this plot, what is the open-loop transfer function?

a. $\frac{k}{(1+sT_1)(1+sT_2)(1+sT_3)}$

b. $\frac{k}{s(1+sT_1)(1+sT_2)(1+sT_3)}$

c. $\frac{k}{s^2(1+sT_1)(1+sT_2)}$

d. $\frac{k}{s^2(1+sT_1)(1+sT_2)(1+sT_3)}$