Objective Paper-I-2011

1. The following equation is not valid for a magnetostatic field in inhomogeneous magnetic materials:
   (A) $\nabla \cdot B = 0$ (B) $\nabla \cdot H = 0$
   (C) $\nabla \times A = B\left(A \text{ is magnetic vector potential}\right)$ (D) $\nabla \times H = J$

2. The normal components of electric flux density across a dielectric-dielectric boundary
   (A) Are discontinuous (B) Are continuous
   (C) Depend on the magnitude of the surface charge density
   (D) Depend on the electric field intensity

3. The electric field intensity phasor of an EM wave in free space is $E = 10e^{-j4y}a_x V/m$. The angular frequency ω, in a radian per second, is
   (A) $4\times3\times10^8$ (B) $4y\times3\times10^8$ (C) $t\times3\times10^8$ (D) $10\times3\times10^8$

4. In free space $\overline{H}$ field is given as: $\overline{H}(Z,t) = \frac{1}{6\pi}\cos(\omega t + \beta Z)\hat{a}_y$. $\overline{E}(Z,t)$ is
   (A) $20\cos(\omega t + \beta Z)\hat{a}_x$ (B) $20\cos(\omega t + \beta Z)\hat{a}_z$
   (C) $20\sin(\omega t + \beta Z)\hat{a}_y$ (D) $20\sin(\omega t + \beta Z)\hat{a}_x$

5. Screw projecting into the waveguide is
   (A) Capacitive discontinuity (B) Inductive discontinuity
   (C) May be capacitive or inductive depending upon the position inside the guide
   (D) None of these

6. Depth of penetration δ is equal to $\frac{\lambda}{2\pi}$ for
   (A) Good insulator (B) Good conductor
   (C) Lossy medium (D) Low values of λ

7. When a plane wave propagates in a dielectric medium
   (A) The average electric energy and the average magnetic energy densities are not equal
   (B) The average electric energy and the average magnetic energy densities are equal
   (C) The net average energy density is finite
   (D) The average electric energy density is not dependent on the average magnetic energy density

8. A transmission line is distortion-less if
   (A) RG=LC (B) RC=GL (C) $\frac{R}{C} = \frac{G}{L}$ (D) R=G

9. If the maximum and minimum voltages on a transmission line are 4V and 2V respectively, for a typical load, VSWR is
(A) 1.0 (B) 0.5 (C) 2.0 (D) 8.0

10. For a lossy transmission line, the characteristic impedance does not depend on
(A) The operating frequency of the line
(B) The conductivity of the inductors
(C) Conductivity of the dielectric separating the conductors
(D) Length of the line

11. A higher directivity is specified by
(A) High gain high bandwidth (B) Low gain high bandwidth
(C) High gain low bandwidth (D) Low gain low bandwidth

12. A lossless transmission line of characteristic impedance $300\,\Omega$ and length $\frac{\lambda}{2}$ is shorted at one end and is terminated in its characteristic impedance at the other. The input impedance measured at the mid section of the line is:
(A) 0Ω (B) 100Ω (C) 300Ω (D) 150Ω

13. The Fermi level in an n-type semiconductor at zero degree Kelvin lies
(A) Below the donor level
(B) Half-way between the conduction band and the donor level
(C) Half-way between the conduction band and the valence level
(D) Close to valence band

14. According to free electron theory, electrons in a metal are subjected to
(A) Constant potential (B) Sinusoidal potential
(C) Square wave potential (D) Non-periodic potential

15. Controlled addition of group III element to elemental semiconductor results in the formation of
(A) Intrinsic semiconductor (B) n-type semiconductor
(C) p-type semiconductor (D) Degenerate semiconductor

16. Photons (Quanta of lattice vibration) obey
(A) Maxwell distribution (B) Maxwell-Boltzmann distribution
(C) Fermi-Dirac distribution (D) Bose-Einstein distribution

17. The Fermi energy E_F of a metal is proportional to (n is the number of free electrons per unit volume of the metal) as
(A) n^2 (B) $n^{1/2}$ (C) $n^{2/3}$ (D) $n^{3/2}$

18. If w is the width of the depletion region in a p-n junction, the transition capacitance is proportional to

(A) w (B) w^2 (C) $\frac{1}{w}$ (D) $\frac{1}{w^2}$

19. The temperature coefficient of a resistance of a doped semiconductor is

(A) Always positive (B) Always negative

(C) Zero

(D) Positive or negative depending on the level of doping

20. The current flow in a semiconductor is due to

1. Drift current
2. Displacement current
3. Diffusion current

(A) 1, 2 and 3 (B) 1 and 2 only (C) 1 and 3 only (D) 2 and 3 only

21. Materials in superconducting state have the property of

(A) Absorbing magnetic field (B) Repelling magnetic field

(C) Absorbing electric field (D) Repelling electric field

22. A superconductor may be used for generating

(A) Voltage (B) Pressure

(C) Temperature (D) Magnetic field

23. As temperature falls below the transition temperature, the value of critical magnetic field of a super-conductor

(A) Remains unchanged (B) Increases

(C) Decreases

(D) First increases, reaches a peak and then decreases

24. The energy gap of a superconductor

(A) Is independent of temperature (B) Increases with temperature

(C) Is maximum at a critical temperature (D) Is minimum at a critical temperature

25. Which of the following properties is not correct for a superconductor in its superconducting stage?

(A) Its resistivity is zero

(B) Magnetic flux density inside the conductor is zero

(C) Its relative permeability is unity

(D) Its magnetic susceptibility is negative

26. Lead

1. is not used to form cable sheaths
2. is least affected by sea water
3. has good malleable and ductile properties
4. will not alloy with many other metals

(A) 1 and 2 are correct
(B) 2 and 3 are correct
(C) 3 and 4 are correct
(D) 1 and 4 are correct

27. The geometrical configuration of one molecule of C_{60} – buck min sterfullerene contains

(A) 12 hexagons and 20 pentagons of carbon atoms
(B) 20 hexagons and 12 pentagons of carbon atoms
(C) 20 hexagons and 20 pentagons of carbon atoms
(D) 12 hexagons and 12 pentagons of carbon atoms

28. Heating a permanent magnet results in the loss of magnetic behaviour because

(A) The atoms start vibrating
(B) The magnetic dipoles start vibrating
(C) The magnetic dipoles start realigning
(D) The atoms start conducting

29. Paramagnetic susceptibility of a material:

(A) Increases linearly with temperature
(B) Decreases linearly with temperature
(C) Increases linearly with $\frac{1}{T}$
(D) Decreases linearly with $\frac{1}{T}$

30. The magnetic domains, during the process of magnetization of ferromagnetic materials

(A) Only expand
(B) Rotate first and then expand
(C) Expand first and then rotate
(D) Neither rotate nor expand

31. If the domain walls in a magnetic material can easily be moved, the material displays

(A) High flux density
(B) High permeability
(C) Permanent magnetic behaviour
(D) High permittivity

32. Magnetic field of earth has no vertical component at

(A) Magnetic poles
(B) Magnetic equator
(C) Latitude 45º
(D) Longitude 45º

33. Match List I with List II and select the correct answer using the code given below the lists:

List I		List II	
P	Magnetic induction	1	Bohr magnetron
Q	Magnetic field	2	Tesla
R	Magnetic moment	3	Henry / meter
S	Permeability	4	Ampere / meter

(A) P-2, Q-1, R-4, S-3 (B) P-3, Q-1, R-4, S-2

(C) P-2, Q-4, R-1, S-3 (D) P-3, Q-4, R-1, S-2

34. Soft iron is used to manufacture electro-magnets because it has

(A) High retentivity (B) High coercive field

(C) Low retentivity (D) Low coercive field

35. Consider the following statements with regards to soft iron

1. It is a magnetic material
2. It conducts electricity
3. It is an alloy of iron and copper
4. It is used to make permanent magnets

Which of these statements are correct?

(A) 1 and 2 (B) 2 and 3 (C) 3 and 4 (D) 1 and 4

36. A permeable substance is one

(A) Which is strong magnetic (B) Which is weak magnetic

(C) Which is a good conductor

(D) Through which magnetic lines of force can pass easily

37. High permittivity ceramic is used for capacitors of

(A) A few pF to few hundred pF (B) A few μF to a few hundred μF

(C) A few nF to few hundred nF (D) A few mF to few hundred mF

38. The commercial thermopiles are formed by

(A) Series of Si-Al thermocouples in an IC by doping Al layers on p-type Si on n-type Si epitaxial layers

(B) Series of Cu-W thermocouple strips

(C) Piezoelectric material strips piled together

(D) Series of bismuth-telluride couples

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

List I		List II	
P	Porcelain	1	Used for high frequency applications
Q	Steatite	2	Used in capacitors to be operated at high frequencies
R	Mica	3	Used for insulators
S	Rutile	4	Releases water when heated

(A) P-3, Q-1, R-4, S-2 (B) P-1, Q-2, R-4, S-3

(C) P-3, Q-4, R-2, S-1 (D) P-1, Q-4, R-2, S-3

40. Diamagnetic materials possess

(A) Permanent dipoles (B) Induced dipoles

(C) Both permanent and induced dipoles (D) No dipoles

41. In the power measurement by ammeter-voltmeter method, if the voltmeter is connected across the load, then the value of the power will be:

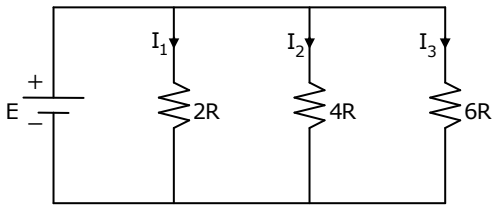
(A) The power consumed by the load

(B) The sum of power consumed by the load and ammeter

(C) The sum of power consumed by the load and voltmeter

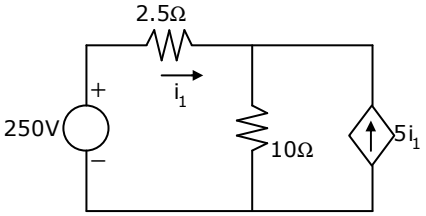
(D) The sum of power consumed by the load, ammeter and voltmeter

42. Three parallel branches of resistors are connected across a d.c. source as shown in the figure. What is $I_1 : I_{2:} : I_3$?



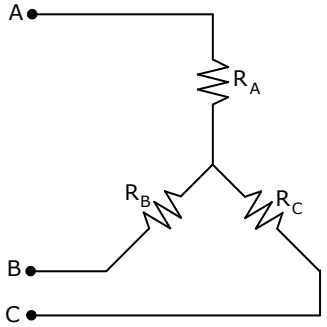
(A) 3:2:6 (B) 2:4:6 (C) 6:3:2 (D) 6:2:4

43. In the circuit shown, the current i_1 is



(A) 4A (B) 2A (C) 4.76A (D) 20A

44. The following are the results of tests conducted on the star-connected load



The resistance between A and B with C open: 12 Ω
The resistance between B and C with A open: 22 Ω
The resistance between C and A with B open: 18 Ω
The individual resistances of R_A, R_B and R_C are, respectively:

(A) 8Ω, 14Ω and 4Ω (B) 10Ω, 2Ω and 8Ω
(C) 4Ω, 8Ω and 14Ω (D) 6Ω, 6Ω and 8Ω

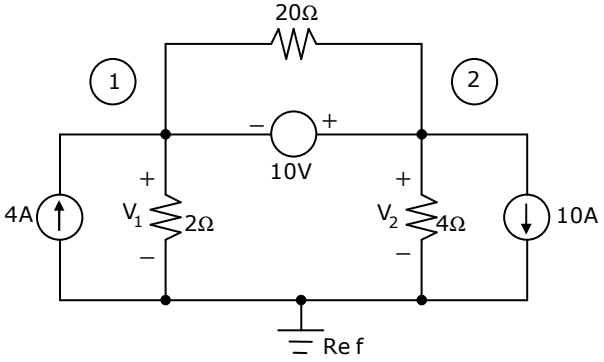
45. When KCL is applied at the super node in the circuit, the current equation in terms of node voltages V_1 and V_2 is:

(A) $-6 = \frac{V_1}{2} + \frac{V_2}{4}$

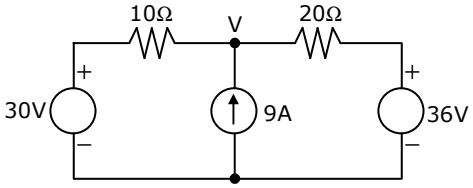
(B) $4 = \frac{V_1 - V_2}{2} + \frac{V_1 - V_2}{20}$

(C) $4 = \frac{V_1}{2} + \frac{V_1 - V_2}{20}$

(D) $4 = \frac{V_1}{2} + \frac{V_2}{4}$



46. The node voltage V in the circuit is:



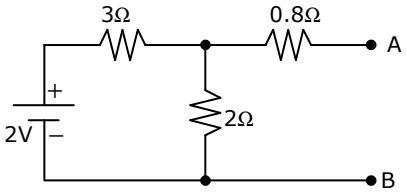
(A) 6V (B) 30V (C) 36V (D) 92V

47. Match List I with List II and select the correct answer using the code given below the lists:

List I		List II	
P	Equivalent circuit	1	Superposition
Q	Linearity	2	Norton's
R	Bilateral	3	Tellegen's
S	Structure	4	Reciprocity

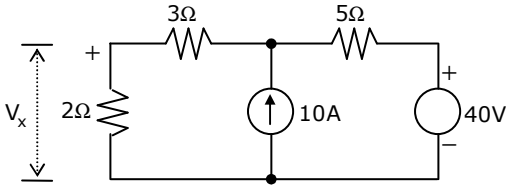
(A) P-3, Q-1, R-4, S-2
(B) P-2, Q-1, R-4, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-4, R-1, S-3

48. The Norton equivalent between A and B for the circuit is:



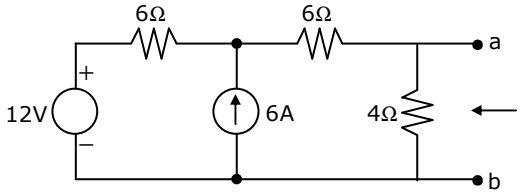
(A) 2A and 2.5 Ω
(B) 0.5A and 1 Ω
(C) 1A and 2 Ω
(D) 0.4A and 2 Ω

49. The voltage V_π across the 2 Ω resistance in the circuit is:



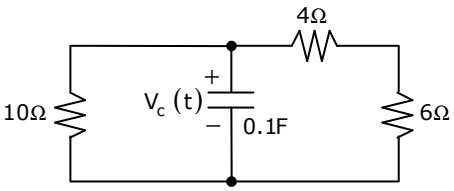
(A) 16 V
(B) 60 V
(C) 18 V
(D) 10 V

50. Thevenin equivalent circuit to the left of the terminals a and b in the circuit, has equivalent voltage source V_{th} and equivalent resistance R_{th}, respectively, as:



(A) 12V and 16Ω
(B) 20V and 4Ω
(C) 12V and 12Ω
(D) 12V and 3Ω

51. In the circuit, if $V_c(0) = 25V$, the expression for $V_c(t)$ for t>0 is:

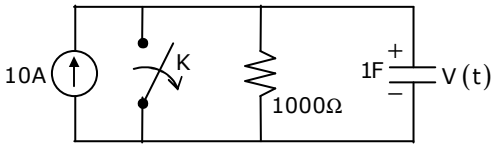


(A) $V_c(t) = 20e^{-0.4t}$ V
(B) $V_c(t) = 25e^{0.4t}$ V
(C) $V_c(t) = 20e^{-2.5t}$ V
(D) $V_c(t) = 25e^{2t}$ V

52. A 0.2H inductor with an initial current of 4A is in parallel with a resistor of $100\,\Omega$. The current at 0.8ms is:

(A) $4e^{-0.4}$A (B) $4e^{-16\times10^{-6}}$A (C) $4e^{-0.4\times10^{-3}}$A (D) $4e^{-16\times10^{-3}}$A

53. In the given network, the switch K is opened at t=0. Then $\frac{dV}{dt}$ at $t=0^+$ is:



(A) 1000V/s (B) 100 V/s (C) 10 V/s (D) 1 V/s

54. For the driving point impedance function of a circuit, $Z(s)=\frac{s+\alpha}{s+\beta}$, α and β real. Then voltage will lead the current if α and β are:

(A) Positive and $\alpha>\beta$ (B) Positive and $\alpha<\beta$

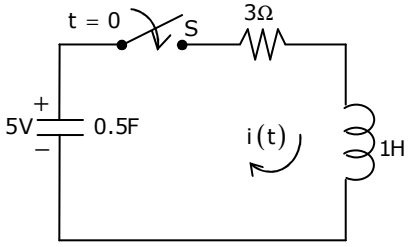
(C) Positive and real negative respectively

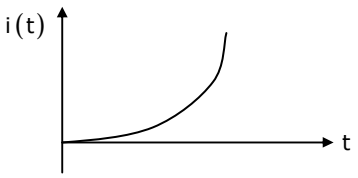
(D) Negative and real positive respectively

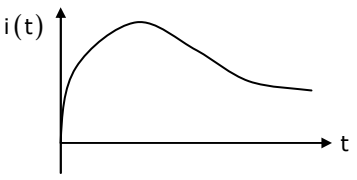
55. A $100\,\Omega$ resistor has an effective inductance of $0.1\,\mu H$ and a distributed capacitance of 10pF. Its time constant at medium frequency is:

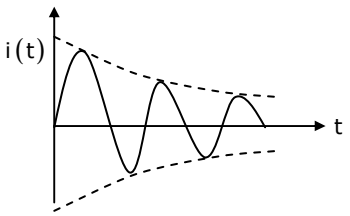
(A) 0ns (B) 1ns (C) 2ns (D) 3ns

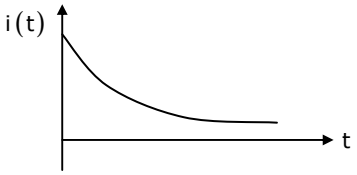
56. The nature of current response $i(t)$ for $t\geq0$ for the network shown is:



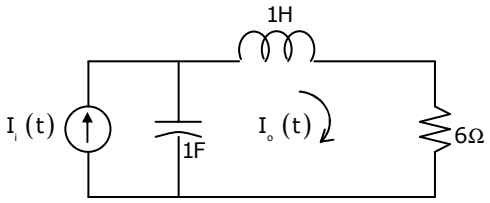
(A)


(B)


(C)


(D)


57. For the circuit shown below, the current gain function $\frac{I_o(s)}{I_i(s)}$ has poles and zeroes as:



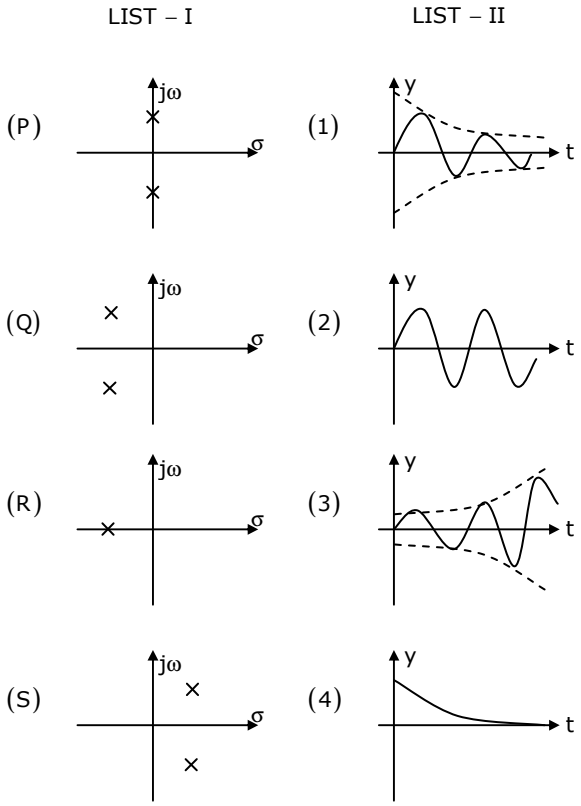
(A) No zeroes; $P_1 = 3+2\sqrt{2}, P_2 = 3-2\sqrt{2}$

(B) $Z_1 = 0,\ Z_2 = 2;\ P_1 = 3+2\sqrt{2}, P_2 = 3-2\sqrt{2}$

(C) No zeroes, $P_1 = 1;\ P_2 = 1$

(D) $Z_1 = 1,\ Z_2 = 1;\ P_1 = 3+j2\sqrt{2},\ P_2 = 3-j2\sqrt{2}$

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



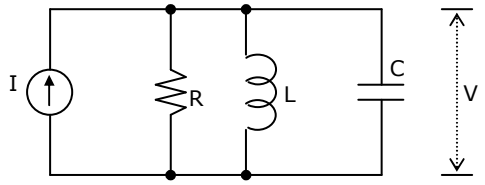
(A) P-3, Q-1, R-4, S-2 (B) P-2, Q-1, R-4, S-3

(C) P-3, Q-4, R-1, S-2 (D) P-2, Q-4, R-1, S-3

59. For the network function $\frac{V(s)}{I(s)} = \frac{s+3}{2s+3}$, then $v(t)$ at t=0 for relaxed circuit with unit step $i(t)$ is:

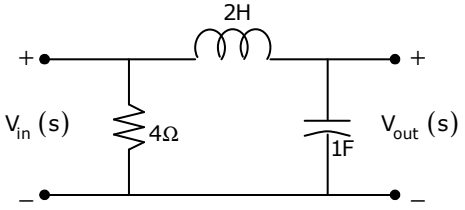
(A) 0.5V (B) 1.0V (C) 1.5V (D) 2.0V

60. For the parallel RLC circuit shown, if $R = 10\Omega$, L=0.1H and C=0.1F, the current I is sinusoidal of frequency equal to the resonant frequency of the circuit, then the current through R is:



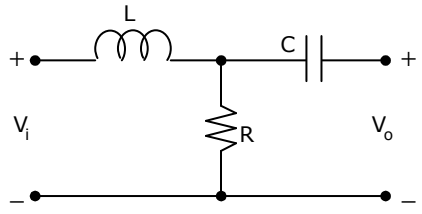
(A) 0 (B) 0.1 I (C) I (D) 10 I

61. The voltage transfer function of the network is:



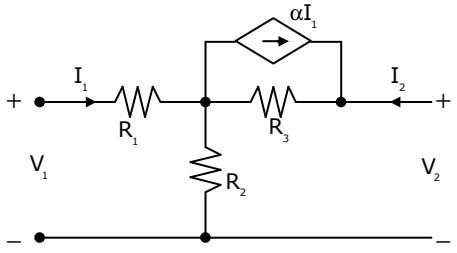
(A) $\frac{1}{1+2s}$ (B) $1+4s$ (C) $6-s$ (D) $\frac{1}{1+2s^2}$

62. The transfer function $\frac{V_o(s)}{V_i(s)}$ of the 2-port network is:



(A) $\frac{1}{1+s\frac{L}{R}}$ (B) $\frac{1+sCR}{sC(R+sL)}$ (C) $\frac{\frac{1}{sC}}{R+sL}$ (D) $\frac{s}{s+\frac{R}{L}}$

63. Consider the two-port network as shown. The hybrid parameter h_{12} is:



(A) $\frac{(\alpha R_3 + R_2)}{R_2 + R_3}$ (B) $\frac{(1-\alpha)R_3}{R_2 + R_3}$ (C) $\frac{(1-\alpha)R_2}{R_2 + R_3}$ (D) $\frac{R_2}{R_2 + R_3}$

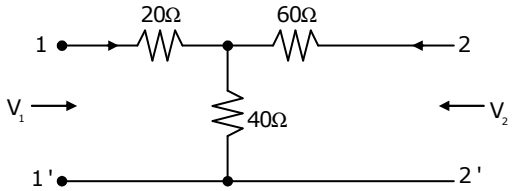
64. A 2-port network is defined by the relation, $V_1 = \frac{3}{4}I_1 + \frac{1}{4}I_2$, $V_2 = \frac{1}{2}I_1 + \frac{1}{2}I_2$. Then y_{12} is:

(A) $\frac{1}{2}$ ℧ (B) $-\frac{1}{2}$ ℧ (C) 1 ℧ (D) -1 ℧

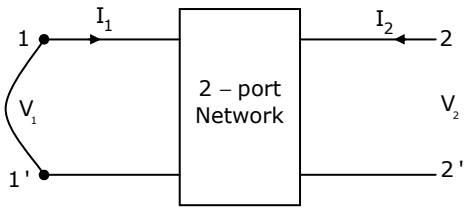
65. For the two-port network, the impedance parameter matrix $[Z] = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$ is:

(A) $\begin{bmatrix} 60\Omega & 100\Omega \\ 40\Omega & 60\Omega \end{bmatrix}$ (B) $\begin{bmatrix} 40\Omega & 100\Omega \\ 60\Omega & 40\Omega \end{bmatrix}$

(C) $\begin{bmatrix} 60\Omega & 40\Omega \\ 40\Omega & 100\Omega \end{bmatrix}$ (D) $\begin{bmatrix} 40\Omega & 100\Omega \\ 100\Omega & 60\Omega \end{bmatrix}$



66. When port-1 of a two-port network is short circuited, $I_1 = 4I_2$ and $V_2 = 0.5I_2$, then which of the following is true?



(A) $Y_{11} = 4$℧ (B) $Y_{12} = 8$℧ (C) $Y_{21} = 16$℧ (D) $Y_{22} = 0.25$℧

67. The driving point impedance function, $Z(s) = \frac{s^2 + 2s + 2}{s^2 + s + 1}$, may be realized by:

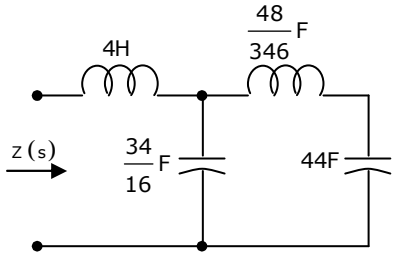
(A) RC network (B) RL network (C) LC network (D) None of these

68. If an RC driving point impedance function, $Z(s)$ has equal number of poles and zeroes at finite locations, then:

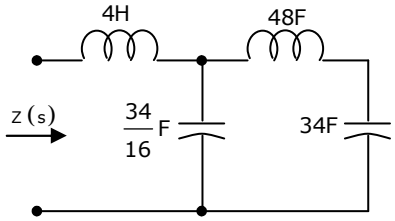
(A) $Z(0) \le Z(\infty)$ (B) $Z(0) \ge Z(\infty)$ (C) $Z(0) < Z(\infty)$ (D) $Z(0) > Z(\infty)$

69. Which one of the following networks represents the Cauer's II[nd] form for the given driving point impedance function $Z(s) = \frac{12s^4 + 10s^2 + 1}{6s^3 + 4s}$?

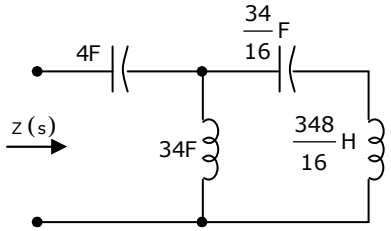
(A)



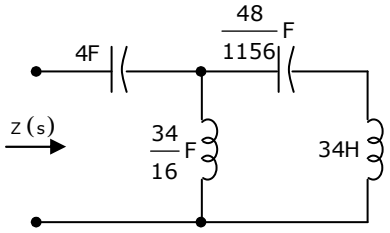
(B)



(C)



(D)



70. Match List I with List II and select the correct answer using the code given below the lists

List I		List II	
P	Work	1	Ampere per meter
Q	Electric field strength	2	Weber
R	Magnetic flux	3	Volt per meter
S	Magnetic field strength	4	Joule

(A) P-4, Q-3, R-2, S-1 (B) P-1, Q-3, R-2, S-4

(C) P-4, Q-2, R-3, S-1 (D) P-1, Q-2, R-3, S-4

71. A 0-100V voltmeter has an accuracy of 1 % at full scale reading. What will be the error if it reads 50V?

(A) 1% (B) 2% (C) 0.5% (D) 4%

72. A resistance of 108 Ω is specified using significant figures as indicated below:

1. 108Ω
2. 108.0Ω
3. 0.000108MΩ

Among these

(A) 1 represents greater precision than 2 and 3

(B) 2 represents greater precision but 1 and 3 represent same precision

(C) 2 and 3 represent greater precision than 1

(D) 1, 2 and 3 represent the same precision

73. What are the causes of gross error in the instruments?

1. Misreading of instruments
2. Incorrect adjustment of instruments
3. Errors due to defective instrument
4. Errors due to effect of environment on the instrument

(A) 1 and 2 (B) 2 and 3 (C) 3 and 1 (D) 4 and 1

74. The measured value of a capacitor is $205.5\,\mu F$; whereas its true value is $202.4\mu F$. The relative error is:

(A) 1.87% (B) 1.94% (C) 1.53% (D) 1.73%

75. Which of the following types of errors come under systematic errors?

1. Irregular spring tension
2. Improper readings of an instrument
3. Loading effects
4. Error due to the presence of electric field or magnetic field

(A) 1 and 2 (B) 2 and 3 (C) 3 and 1 (D) 4 and 1

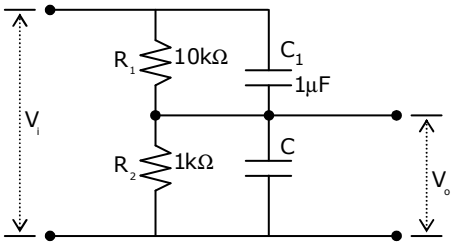
76. The value of a quantity and its uncertainty are given as 26455 ± 3754 without rounding off. Only two significant digits are relevant for error. Value of error rounded off to two significant figures is:

(A) 26500 ± 3800 (B) 26400 ± 3800 (C) 26460 ± 3750 (D) 26400 ± 3700

77. The value of a shunt resistance required to convert an ammeter of 1mA with $100\,\Omega$ internal resistances into 0-100mA ammeter is:

(A) $2.2\,\Omega$ (B) $1.01\,\Omega$ (C) $1.2\,\Omega$ (D) $1.1\,\Omega$

78. A RC potentiometer to measure ac voltage, it is desired that $\frac{V_o}{V_i}$ should be independent of frequency. The value of C should be:



(A) $10\,\mu F$ (B) $11\,\mu F$ (C) $0.1\,\mu F$ (D) $0.09\,\mu F$

79. The current and potential coils of a dynamometer type wattmeter were accidentally interchanged while connecting. After energizing the circuit, it was observed that the wattmeter did not show the reading. This could be due to the:

(A) Damage to potential coil

(B) Damage to current coil

(C) Damage to both the potential and current coil

(D) Loose contacts

80. Consider the following statements associated with an energy meter:

1. It is an integrating type instrument
2. It is an induction type instrument
3. It uses a permanent magnet for rotation of aluminium disc
4. It employs a high control torque

Which of these statements are correct?

(A) 1, 2, 3 and 4 (B) 1 and 2 only (C) 2 and 3 only (D) 3 and 4 only

81. A capacitor is connected across a portion of resistance of the multiplier in order to make the pressure coil circuit of the wattmeter non-inductive. The value of this resistance is r, while the total resistance of inductance of the pressure circuit are respectively R_p and L. The value of capacitance C is:

(A) $\frac{L}{R_p^2}$ (B) $\frac{0.41L}{r^2}$ (C) $\frac{L}{r^2}$ (D) $\frac{0.41L}{R_p^2}$

82. The magnetic field responsible for the production of the deflecting torque in an accurate dynamometer type wattmeter, being very weak, the accuracy of the measurement can be increased by providing a:

(A) Magnetic shield around the instrument
(B) Compensating winding along with the pressure coil
(C) A-static arrangement to the moving system of the instrument
(D) Capacitance shunt across a portion of the pressure coil

83. Consider the following statements regarding the controlling torque:

1. It is not present in power factor meter
2. It opposes the deflecting torque
3. It is provided by air friction or by fluid friction

Which of these statements are correct?

(A) 1, 2 and 3 (B) 1 and 3 only (C) 2 and 3 only (D) 1 and 2 only

84. Consider the following statements in connection with deflection and null type instruments:

1. Null type instrument is more accurate than the deflection type one
2. Null type instrument can be highly sensitive as compared with deflection type instrument
3. Under dynamic conditions, null type instrument is not preferred to deflection type instrument
4. Response is faster in null type instrument as compared to deflection type instrument

Which of these statements are correct?

(A) 1, 2 and 3 only (B) 1, 2 and 4 only (C) 2, 3 and 4 only (D) 1, 2, 3 and 4

85. Match List I with List II and select the correct answer using the code given below the lists

List I		List II	
P	Moving iron and hot wire type	1	Air friction
Q	Galvanometer	2	Electromagnetic
R	PMMC type	3	Fluid friction
S	Electrostatic type	4	Eddy current

(A) P-1, Q-4, R-2, S-3 (B) P-3, Q-4, R-2, S-1
(C) P-1, Q-2, R-4, S-3 (D) P-3, Q-1, R-2, S-4

86. Match List I with List II and select the correct answer using the code given below the lists

List I		List II	
P	Average value of current	1	Self-balancing bridge
Q	Frequency of a wave form	2	Wein's bridge
R	Strain-gauge resistance	3	PMMC ammeter

(A) P-2, Q-1, R-3 (B) P-3, Q-1, R-2 (C) P-1, Q-2, R-3 (D) P-3, Q-2, R-1

87. In a vibrating reed type frequency meter, all the reeds:
(A) Are of identical dimensions and weight
(B) Have different natural frequencies
(C) Have the same natural frequencies
(D) Are not placed close to an electromagnet

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

List I		List II	
P	Hay bridge	1	Medium resistance
Q	Wheatstone Bridge	2	Frequency
R	Wein bridge	3	Capacitance
S	Schering bridge	4	High Q-inductance

(A) P-4, Q-2, R-1, S-3 (B) P-3, Q-2, R-1, S-4
(C) P-4, Q-1, R-2, S-3 (D) P-3, Q-1, R-2, S-4

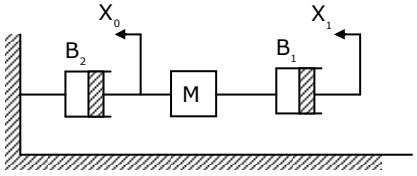
89. Due to the effect of inductance in the pressure coil, a dynamometer type wattmeter
(A) Reads low on lagging power factor and high on leading power factor
(B) Reads high on lagging power factor and low on leading power factor
(C) Reading is independent of the power factor
(D) Always reads lower than the actual value

90. The full scale input voltage to an ADC is 10V. If the resolution required is 5mV, the minimum number of bits required for ADC is:
(A) 8 (B) 10 (C) 11 (D) 12

91. Which of the following is not a self-generating type transducer?

(A) Thermocouple and thermopile
(B) Piezoelectric pick-up
(C) Photovoltaic cell
(D) Magnetostriction gauge

92. For the mechanical system with mass and viscous friction components, shown in figure, $\frac{X_o(s)}{X_i(s)}$ is:



(A) $\frac{B_2}{Ms + B_1 + B_2}$

(B) $\frac{B_2}{Ms^2 + (B_1 + B_2)s}$

(C) $\frac{B_1}{Ms + B_1 + B_2}$

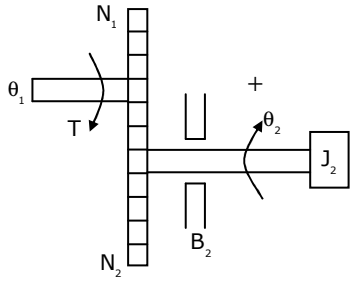
(D) $\frac{B_1}{Ms^2 + (B_1 + B_2)s}$

93. Match List I with List II and select the correct answer using the code given below the lists

List I		List II	
P	Mass	1	Capacitor
Q	Damper	2	Voltage
R	Spring	3	Resistor
S	Force	4	Inductor

(A) P-2, Q-1, R-3, S-4
(B) P-4, Q-1, R-3, S-2
(C) P-2, Q-3, R-1, S-4
(D) P-4, Q-3, R-1, S-2

94. Consider the following relations with regard to the shown gear trains:



1. $\frac{\theta_1}{\theta_2} = \frac{N_2}{N_1}$

2. $T_2 = J_2 \frac{d^2\theta_2}{dt^2} + B_2 \frac{d\theta_2}{dt}$

3. $T_1 = J_2 \left(\frac{N_1}{N_2}\right)^2 \frac{d^2\theta_1}{dt^2} + B_2 \left(\frac{N_1}{N_2}\right)^2 \frac{d\theta_1}{dt}$

Which of these relations are correct?

(A) 1, 2 and 3 (B) 1 and 2 only (C) 2 and 3 only (D) 1 and 3 only

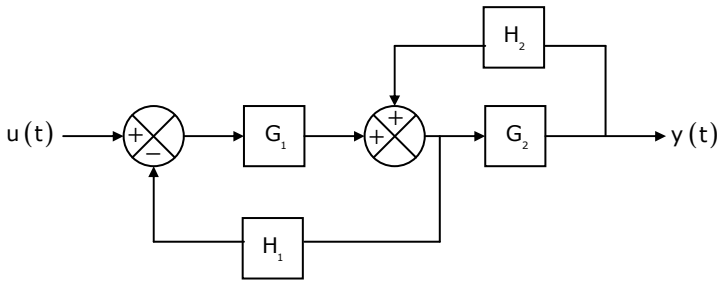
95. The system transfer function for the block diagram shown is:

(A) $\dfrac{G_1G_2}{1-G_2H_2+G_1H_1}$

(B) $\dfrac{G_1G_2}{1-G_1H_1+G_2H_1}$

(C) $\dfrac{G_1G_2H_1}{1+G_2H_1+G_1H_1}$

(D) $\dfrac{G_1G_2H_1}{1+G_2H_2+G_1H_1}$



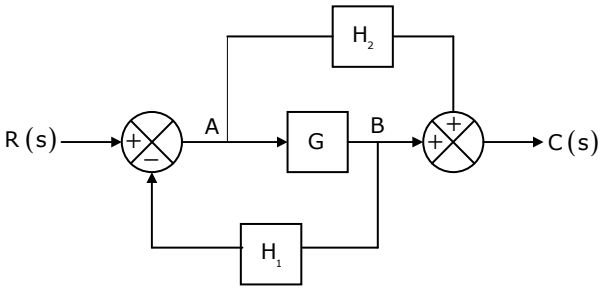
96. The transfer function $\dfrac{C(s)}{R(s)}$ for the system shown below is:

(A) $\dfrac{G+H_1}{1+GH_2}$

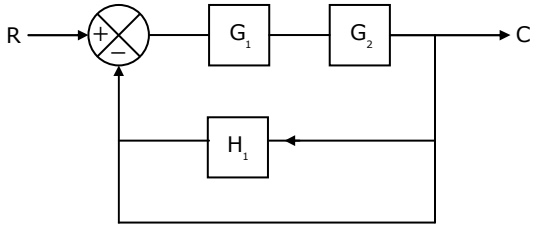
(B) $\dfrac{G+H_2}{1+GH_1}$

(C) $\dfrac{H_2}{1+GH_1}$

(D) $\dfrac{GH_2}{1+GH_1}$



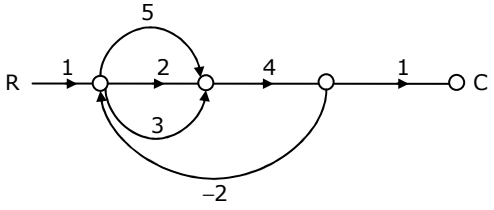
97. The resulting equivalent transfer function of the system shown below is:



(A) $\dfrac{G_1G_2}{1+G_1G_2+G_1G_2H_1}$ (B) $\dfrac{G_1G_2}{1+G_1G_2+G_1H_1}$ (C) $\dfrac{G_1G_2}{1+G_1H_1G_2}$ (D) $\dfrac{G_1G_2}{1+G_1G_2+H_1}$

98. Consider the following statements with regards to signal flow graph:

1. The number of loops are 3
2. The number of loops are 2
3. The number of forward paths are 3
4. $\dfrac{C}{R}$ ratio is $\dfrac{40}{81}$
5. $\dfrac{C}{R}$ ratio is $\dfrac{28}{81}$



Which of these statements are correct?

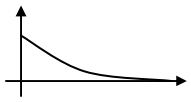
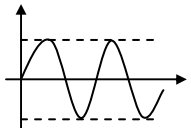
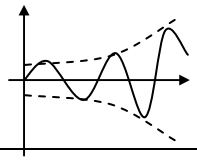
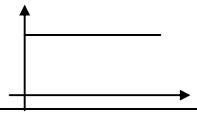
(A) 1, 3, 4 and 5 (B) 1, 3 and 4 (C) 2, 3 and 4 (D) 3, 4 and 5

99. The transfer function of a linear control system is given by:

$G(s)=\dfrac{100(s+15)}{s(s+4)(s+10)}$. In its Bode diagram, the value of gain for $\omega=0.1\text{rad/s}$ is:

(A) 20dB (B) 40dB (C) 60dB (D) 80dB

100. Match List I with List II and select the correct answer using the code given below the lists

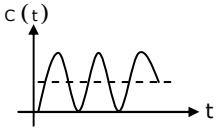
List I		List II	
P	Two imaginary roots	1	
Q	Two complex roots in RH of s-plane	2	
R	A single root on negative real axis		
S	A single root at the origin	4	

(A) P-4, Q-1, R-3, S-2 (B) P-2, Q-1, R-3, S-4

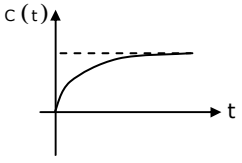
(C) P-4, Q-3, R-1, S-2 (D) P-2, Q-3, R-1, S-4

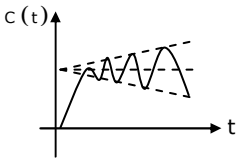
101. Match List I with List II and select the correct answer using the code given below the lists

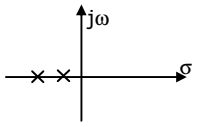
LIST – I LIST – II

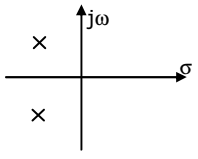
(P) 

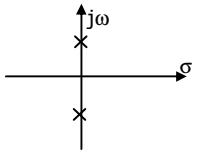
(Q) 

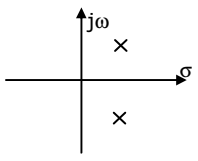
(R) 

(S) 

(1) 

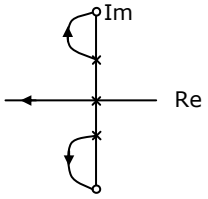
(2) 

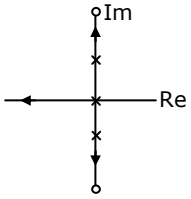
(3) 

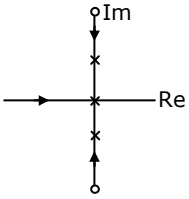
(4) 

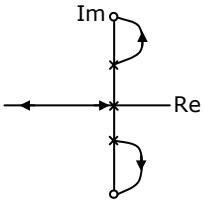
(A) P-4, Q-1, R-2, S-3 (B) P-3, Q-1, R-2, S-4
(C) P-4, Q-2, R-1, S-3 (D) P-3, Q-2, R-1, S-4

102. Loop transfer function of unity feedback system is $G(s)=\frac{K(s^2+64)}{s(s^2+16)}$. The correct root locus diagram for the system is:

(A) 

(B) 

(C) 

(D) 

103. The breakaway point in the root loci plot for the loop transfer function $G(s)H(s)=\frac{K}{s(s+3)^2}$ is:

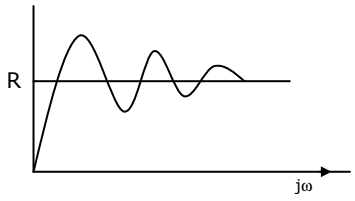
(A) -2.5 (B) -2.0 (C) -1.0 (D) -0.5

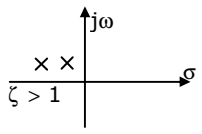
104. Consider the following statements regarding root loci plot:
1. When gain K is zero, the roots coincide with the poles
2. When K is increased, the roots move away from the poles
3. A root locus diagram is always symmetric about the imaginary axis
4. The number of branches terminates on infinity is open loop poles plus zeros

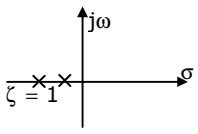
Which of these statements are correct?

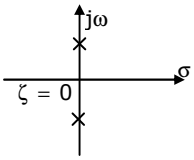
(A) 1 and 2 (B) 2 and 3 (C) 3 and 4 (D) 1, 2, 3 and 4

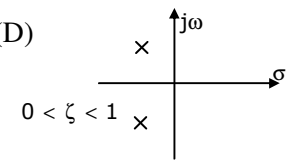
105. For the response shown, the correct root locations in the s-plane are:



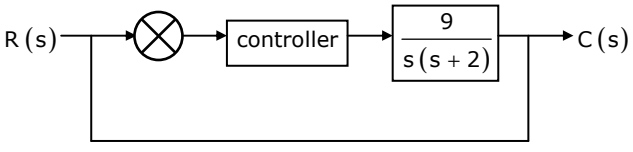
(A) 

(B) 

(C) 

(D) 

106. In the control system shown below, the controller which can give zero steady state error to a ramp input is of:



(A) Proportion type
(B) Integral type
(C) Derivative type
(D) Proportional plus derivative type

107. Let $\dot{x} = \begin{bmatrix} 1 & 2 \\ 0 & b \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ where b is an unknown constant. This system is:

(A) Uncontrollable for b=1
(B) Uncontrollable for b=0
(C) Uncontrollable for all values of b
(D) Controllable for all values of b

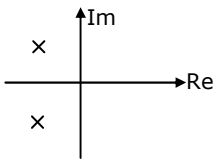
108. The state variable description of a linear autonomous system is $\dot{x} = Ax$ where x is the two-dimensional state vector and A is given by:

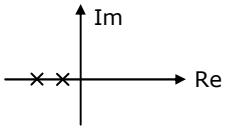
$A = \begin{bmatrix} 0 & -2 \\ -2 & 0 \end{bmatrix}$. The poles of the system are located at:

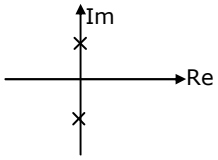
(A) 2 and +2 (B) -2j and +2j (C) -2 and -2 (D) +2 and +2

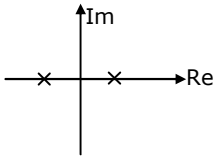
109. Match List I with List II and select the correct answer using the code given below the lists

LIST – I

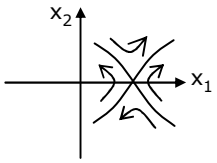
(P) 

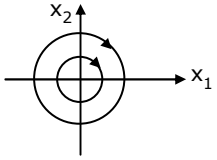
(Q) 

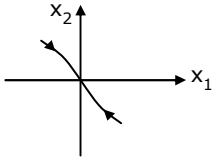
(R) 

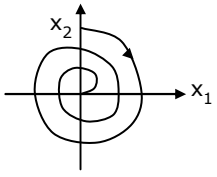
(S) 

LIST – II

(1) 

(2) 

(3) 

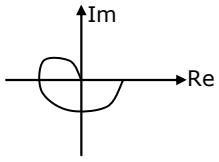
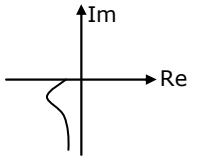
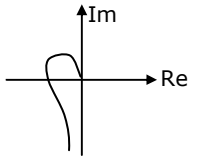
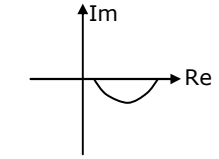
(4) 

(A) P-1, Q-2, R-3, S-4
(B) P-4, Q-3, R-2, S-1
(C) P-1, Q-3, R-2, S-4
(D) P-4, Q-2, R-3, S-1

110. For a tachometer, if $\theta(t)$ is the rotor displacement, $e(t)$ is the output voltage and K is the tachometer constant, then the transfer function is defined as:

(A) Ks^2 (B) $\frac{K}{s}$ (C) Ks (D) K

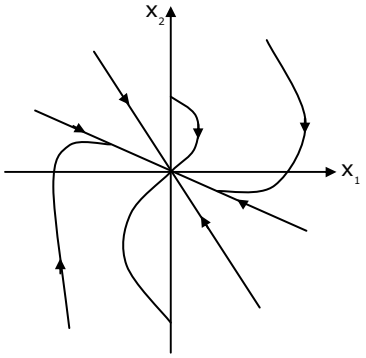
111. Match List I with List II and select the correct answer using the code given below the lists

List I		List II	
P	$G(s)=\frac{1+sT}{1+2sT}$	1	
Q	$G(s)=\frac{1}{(1+sT_1)(1+sT_2)(1+sT_3)}$	2	
R	$G(s)=\frac{1+sT_1}{s(1+sT_2)(1+sT_3)}$	3	
S	$G(s)=\frac{\omega_n^2}{s(s^2+2\zeta\omega_n s+\omega_n^2)}$	4	

(A) P-3, Q-2, R-1, S-4 (B) P-4, Q-2, R-1, S-3

(C) P-3, Q-1, R-2, S-4 (D) P-4, Q-1, R-2, S-3

112. The figure shown is a phase-plane representation of trajectories. The singular point shown is a:



(A) Unstable node (B) Saddle point (C) Stable focus (D) Stable node

Directions: -

Each of the next Eight (8) items consists of two statements, one labeled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

(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

113. **Assertion (A)** : T he electric field around a positive charge is outward

Reason (R) : Gauss law states that the differential of the normal component of the outward electric flux density over a closed surface yields the positive charge enclosed

114. **Assertion (A)** : Electromagnetic waves propagate being guided by parallel plate perfect conductor surface.

Reason (R) : Tangential component of electric field intensity and normal component of magnetic field intensity are zero on a perfect conductor surface

115. **Assertion (A)** : A thin sheet of conducting material can act as a low-pass filter for electromagnetic waves.

Reason (R) : The penetration depth is inversely proportional to the square root of the frequency.

116. **Assertion (A)** : Superconductors cannot be used as coils for production of strong magnetic fields.

Reason (R) : Superconductivity in a wire may be destroyed if the current in the wire exceeds a critical value.

117. **Assertion (A)** : A network is said to be in resonance when the voltage and current at the network input terminals are in phase.

Reason (R) : In a two-terminal network containing atleast one inductor and one capacitor, the resonance is defined as the condition which exists when the input impedance of the network is purely resistive.

118. **Assertion (A)** : It is always desirable to take measurements as close to the full scale as possible.

Reason (R) : The magnitude of the limiting error is a fixed quantity based on the full-scale reading of the meter and error increases as reading decreases.

119. **Assertion (A)** : Electrodynamometer wattmeter is not suitable for low power factor power measurement.

Reason (R) : Many wattmeter's are compensated for errors caused by inductance of voltage coil by means of a capacitor connected in parallel with a portion of multiplier series resistance.

120. **Assertion (A)** : AC bridge methods are the best and most usual methods for the precise measurement of self and mutual inductances and capacitances.

Reason (R) : Wagner earthing device is used in AC bridge for eliminating the effect of the earth capacitance.