1. The dominant poles of a servo-system are located at $s = (-2 \pm j2)$. The damping ratio of the system is

(a) 1

(b) 0·8

(c) 0·707

(d) 0·6

2. For a unity feedback control with $G(s) = \frac{9}{s(s+3)}$, the damping ratio is

(a) 0·5

(b) 1

(c) 0·707

(d) 0·33

3. The overall transfer function of a second order control system is given by,

$$\frac{C(s)}{R(s)} = \frac{2}{s^2 + 3s + 2}.$$

The time response of this system, when subjected to a unit step response is

(a) $1 - e^{-2t} + 2e^{-t}$

(b) $1 + e^{-2t} + 2e^{-t}$

(c) $1 - 2e^{-t} + e^{-2t}$

(d) $1 + e^{-2t}$

4. The position and velocity error coefficients for the system of transfer function,

$$G(s) = \frac{50}{(1 + 0{\cdot}1s)(1 + 2s)}$$

are respectively

(a) Zero and zero

(b) Zero and infinity

(c) 50 and zero

(d) 50 and infinity

5. Consider the open-loop transfer function :

$$G(s)H(s) = \frac{5(s+1)}{s^2(s+5)(s+12)}$$

The steady-state error due to a ramp input is

(a) 0

(b) 5

(c) 12

(d) ∞

6. What will be the gain margin in dB of a system having the following open loop transfer function ?

$$G(s)H(s) = \frac{2}{s(s+1)}$$

(a) 0

(b) 2

(c) $\frac{1}{2}$

(d) ∞

7. For a unit step input, a system with forward path transfer function

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

and feedback path transfer function $H(s) = (s + 5)$ has a steady-state output of

(a) 2

(b) 0·5

(c) 1

(d) 0·2

8. By adding a pole at the origin of s-plane, the Nyquist plot of a system will rotate by

(a) 90° in anti-clockwise direction

(b) 90° in clockwise direction

(c) 180° in anti-clockwise direction

(d) 180° in clockwise direction

9. The characteristic equation of a feedback control system is

$$s^4 + s^3 + 2s^2 + 4s + 15 = 0.$$

The number of roots in the right half of the s-plane is

(a) 4

(b) 3

(c) 2

(d) 1

10. In the Bode plot of a unity feedback control system, the value of phase of $G(j\omega)$ at the gain cross-over frequency is $-125°$. The phase margin of the system is

(a) $-125°$

(b) $-55°$

(c) $55°$

(d) $125°$

11. The correct sequence of steps needed to improve system stability is

(a) Insert derivation action, Use negative feedback and Reduce gain

(b) Reduce gain, Use negative feedback and Insert derivation action

(c) Reduce gain, Insert derivation action and Use negative feedback

(d) Use negative feedback, Reduce gain and Insert derivation action

12. Which of the following points is ***not*** on the root locus of a system with the given open loop transfer function ?

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

(a) $s = -j\sqrt{3}$

(b) $s = -1{\cdot}5$

(c) $s = -3$

(d) $s = -\infty$

13. The effect of integral controller on the steady-state error e_{ss} and that on the relative stability R_s of the system is

(a) Both are increased

(b) e_{ss} is increased but R_s is reduced

(c) e_{ss} is reduced but R_s is increased

(d) Both are reduced

14. The state equations in the phase variable canonical form can be obtained from the transfer function by

(a) Cascade decomposition

(b) Direct decomposition

(c) Inverse decomposition

(d) Parallel decomposition

15. The transfer function of a zero order hold is given by

(a) $\frac{1}{s}$

(b) $1 - e^{-Ts}$

(c) $s(1 - e^{-Ts})$

(d) $\frac{1 - e^{-Ts}}{s}$

16. With negative feedback, the system stability and system gain respectively

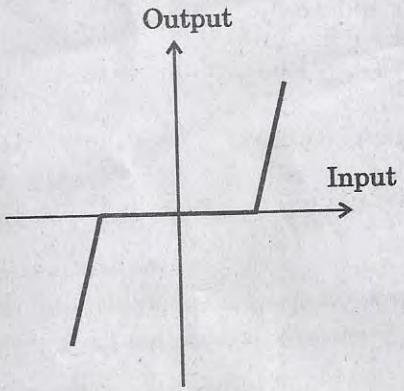
(a) Increases and increases

(b) Increases and decreases

(c) Decreases and increases

(d) Decreases and decreases

17.



This non-linearity represents

(a) Dead zone

(b) Coulomb friction

(c) Saturation

(d) Hysteresis

18. What is the number of turns of wire needed to provide a potentiometer with a resolution of 0·05 percent ?

(a) 200 turns

(b) 2000 turns

(c) 20 turns

(d) 20000 turns

19. Consider the following properties attributed to state model of a system :

1. State model is unique.
2. Transfer function for the system is unique.
3. State model can be derived from transfer function of the system.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

20. A discrete time system is stable if all the roots of the characteristic equation lie

(a) Outside the circle of unit radius

(b) Within the circle of unit radius

(c) Outside the circle of radius equal to 3-units

(d) On the circle of infinite radius

21. The electric field lines and equipotential lines

(a) are parallel to each other

(b) are one and the same

(c) cut each other orthogonally

(d) can be inclined to each other at any angle

22. According to Gauss's Law, the surface integral of the normal component of electric flux density D over a closed surface containing charge Q is

(a) $\frac{Q}{\varepsilon_0}$

(b) $\varepsilon_0 Q$

(c) Q

(d) $\frac{Q^2}{\varepsilon_0}$

23. Consider the following statements :

A current I flows through a circular coil of one turn of radius R in the counter-clockwise direction.

1. The magnetic field at the centre is inversely proportional to R.
2. The magnetic moment of the coil is directly proportional to R^2.
3. The magnetic field at its centre is directly proportional to R^2.

Which of the above statements is/are correct ?

(a) 1 and 2

(b) 1 only

(c) 2 and 3

(d) 3 only

24. The depth of penetration of a wave in a lossy dielectric medium increases with
(a) Increasing wavelength
(b) Increasing conductivity
(c) Decreasing wavelength
(d) Increasing permittivity

25. Consider the following statements associated with the basic electrostatic properties of ideal conductors :
1. The resultant field inside is zero.
2. The net charge density in the interior is zero.
3. Any net charges reside on the surface.
4. The surface is always equipotential.
5. The field just outside is zero.

Which of the above statements are correct ?
(a) 1, 2, 3 and 4
(b) 3, 4 and 5 only
(c) 1, 2 and 3 only
(d) 2 and 3 only

26. In practice, Earth is chosen as a place of zero electric potential because it
(a) is non-conducting
(b) is easily available reference
(c) keeps losing and gaining electric charge every day
(d) has almost constant potential

27. The capacitance of a concentric spherical capacitor of shell radii x and y (x > y) is
(a) $\frac{1}{4\pi\varepsilon_0} ln \frac{x}{y}$
(b) $\frac{4\pi\varepsilon_0 xy}{x-y}$
(c) $4\pi\varepsilon_0 ln \frac{y}{x}$
(d) $\frac{1}{4\pi\varepsilon_0}\left[\frac{1}{y}-\frac{1}{x}\right]$

28. The frequency of the power wave associated with an electromagnetic wave having an E field as $E = e^{-z/\delta} \cos(\omega t - \frac{z}{\delta})$, is given by
(a) $\frac{\omega}{8\pi}$
(b) $\frac{\omega}{4\pi}$
(c) $\frac{\omega}{2\pi}$
(d) $\frac{\omega}{\pi}$

29. When the wave travels in a conducting medium, the rate of attenuation is decided by
(a) Attenuation constant
(b) Phase constant
(c) Both attenuation constant and phase constant
(d) Neither attenuation constant nor phase constant

30. Uniform plane wave is
(a) Longitudinal in nature
(b) Transverse in nature
(c) Neither longitudinal nor transverse in nature
(d) x-directed

31. The impedance Z offered by transmission line for a travelling wave which damps out the low frequency oscillation rapidly is also called
(a) Surge impedance
(b) Natural impedance
(c) Both surge and natural impedances
(d) Neither surge nor natural impedance

32. In a coaxial transmission line, the useful power flows through
(a) the interface of the two conductors
(b) both inner and outer conductors
(c) inner conductor
(d) outer conductor

33. For a line to have a purely resistive characteristic impedance

(a) $\frac{C}{G} = \frac{R}{L}$

(b) $\omega L = \frac{1}{\omega C}$

(c) $R = G$

(d) $GL = RC$

where R and G are resistance and conductance per unit length respectively and L and C are inductance and capacitance per unit length respectively.

34. A semiconductor device made out of a material having very high temperature coefficient of resistance is

(a) Transistor

(b) Varistor

(c) Thyristor

(d) Thermistor

35. The electrical conductivity of a semiconductor increases with increase in temperature because

(a) the carrier concentration increases

(b) the mobility of carrier increases

(c) both carrier concentration and mobility increase

(d) the band gap decreases

36. Which of the following are associated with soft superconductors ?

1. Silsbee's rule
2. Meissner effect
3. Faraday rotation
4. Curie-Weiss law

(a) 2, 3 and 4

(b) 1 and 3 only

(c) 1 and 2 only

(d) 2 and 3 only

37. In a two-channel oscilloscope operating in x-y mode, two in-phase 50 Hz sinusoidal waveforms of equal amplitude are fed to the two channels. What will be the resultant pattern on the screen ?

(a) An ellipse

(b) A parabola

(c) Straight line inclined at 45° with respect to x-axis

(d) A circle

38. Materials, whose resistivity at very low temperatures plunges from a finite value to zero and remains there upon further cooling, are known as

(a) Ferromagnetic materials

(b) High-energy hard magnetic materials

(c) Superconductors

(d) Ferrimagnetic materials

39. In a superconductor, if the temperature is decreased below its critical temperature, the value of critical magnetic field will

(a) Increase

(b) Decrease

(c) Not change

(d) Increase or decrease depending on the superconductor material

40. The imaginary part of dielectric constant determines

(a) Component of current which is in phase with the applied field

(b) Component of energy absorbed per m^3

(c) Amount of applied field

(d) Component of voltage which is in phase with the applied field

Directions : *Each of the next* ***twenty (20)*** *items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below :*

Codes :

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is ***not*** the correct explanation of Statement (I)

(c) Statement (I) is true but Statement (II) is false

(d) Statement (I) is false but Statement (II) is true

41. *Statement (I) :*

At 50 Hz the depth of penetration is 8·5 mm. At 30 GHz the depth of penetration is 0·00038 mm.

Statement (II) :

A high frequency field attenuates as it penetrates conduction in a shorter distance than a low frequency field.

42. *Statement (I) :*

A semi-conductor is not capable of sustaining the movement of free negative electrons, but capable of positive charges or holes.

Statement (II) :

The positive charges cannot be positrons because to liberate the latter, an energy as high as one million eV or more would be required.

43. *Statement (I) :*

Hard magnetic materials are used for making permanent magnets.

Statement (II) :

Hard magnetic materials have relatively small and narrow hysteresis loop.

44. *Statement (I) :*

Servo motors have small diameter and large axial length.

Statement (II) :

Servo motors must have low inertia and high starting torque.

45. *Statement (I) :*

The magnetic moments of diamagnetic materials are mainly due to the orbital angular momentum of the electrons.

Statement (II) :

A steady current flowing in the orbit produces a magnetic field equivalent to that set up by a dipole perpendicular to the plane of orbit (Ampere's law).

46. *Statement (I) :*

Under steady-state condition, a pure capacitor behaves as an open circuit for direct voltage.

Statement (II) :

The current through a capacitor is proportional to the rate of change of voltage.

47. *Statement (I) :*

During resonance, an R-L-C series circuit behaves like a purely resistive circuit.

Statement (II) :

During resonance in an R-L-C series circuit, the voltages across the L- and the C-elements are in phase to each other.

48. *Statement (I) :*

The simplest method of power measurement is by means of electrodynamic type wattmeters, having two fixed coils, and one moving coil.

Statement (II) :

Either of the fixed and the moving coils can be used as the current or the voltage coils.

49. *Statement (I) :*

A permanent magnet moving coil instrument is always slightly under damped.

Statement (II) :

The pointer of the PMMC instrument should overshoot a little beyond the steady-state position to give the accurate reading.

50. *Statement (I) :*
Bridge measurements are considered to be more accurate as compared to measurements done using indicating instruments.

Statement (II) :
In a bridge measurement, the accuracy of the components used in the different arms of the bridge alone comes into picture.

51. *Statement (I) :*
RF voltage is measured by rectifying the alternating voltage first and then amplifying the resulting dc output.

Statement (II) :
Amplification of RF signal itself is very difficult.

52. *Statement (I) :*
Before making any voltage measurement using electronic voltmeter, it is desirable to short circuit its input and make zero-adjustment to ensure correct reading.

Statement (II):
Drift in the dc amplifier of the electronic voltmeter may indicate output without any input voltage present.

53. *Statement (I) :*
Platinum resistance thermometers are widely used for temperature measurements for variety of industrial applications.

Statement (II) :
Platinum resistance thermometers provide the highest temperature sensitivity as compared to all known temperature transducers.

54. *Statement (I) :*
Flash analog-to-digital conversion is the fastest but an expensive method for designing ADCs.

Statement (II) :
Flash analog-to-digital converters are employed on very high speed digital acquisition systems.

55. *Statement (I) :*
Transfer function approach is inadequate, when time domain solution is required.

Statement (II) :
All initial conditions of the system are neglected in derivation of transfer function.

56. *Statement (I) :*
The polar plot has limitation for portraying the frequency response of a system.

Statement (II) :
The calculation of frequency response is tedious and does not indicate the effect of the individual poles and zeros.

57. *Statement (I) :*
A large resonance peak in frequency response also corresponds to a large peak overshoot in transient response.

Statement (II) :
All the systems which exhibit overshoot in time response will also exhibit resonance peak in frequency response.

58. *Statement (I) :*
The state feedback design is more realistic than conventional fixed configuration controller design.

Statement (II) :
The disadvantage with the state feedback is that all the states must be sensed and fed back for control.

59. *Statement (I) :*
For radar tracking systems, signals are available in the form of pulse trains.

Statement (II) :
The stability of a discrete-time system is decreased as the sampling period is shortened.

60. *Statement (I) :*
Soft magnetic materials are not used in the construction of permanent magnets.

Statement (II) :
Soft magnetic materials have narrow hysteresis loop, low retentivity and low coercivity.

61. Curie law of paramagnetism (with χ = susceptibility, B = flux density and C = a constant) is

(a) $\chi = CT$

(b) $\chi = \frac{CB}{T}$

(c) $\chi = \frac{CT^2}{2B}$

(d) $\chi = \frac{C}{T}$

62. If the magnetic susceptibility of a specimen is small and positive, the specimen is

(a) Diamagnetic
(b) Paramagnetic
(c) Ferromagnetic
(d) Non-magnetic

63. Manganese ferrite is a 1 : 1 mixture of

(a) Manganese nitride and iron oxide
(b) Manganese oxide and iron oxide
(c) Manganese nitride and iron sulphide
(d) Manganese oxide and iron sulphide

64. When a ferromagnetic substance is magnetized, small changes in dimensions occur. Such a phenomenon is known as

(a) Magnetic hysteresis
(b) Magnetic expansion
(c) Magnetostriction
(d) Magneto-calorisation

65. In ferromagnetic, anti-ferromagnetic and ferrimagnetic materials, the atomic thermal motions counteract the coupling forces between the adjacent atomic dipole moments, thereby causing

(a) Some dipole misalignment regardless of whether an external field is present
(b) Increase in dipole alignment regardless of whether an external field is present
(c) No effect on dipole alignment
(d) Atoms tend to de-randomize the direction of moments

66. The Hall Effect voltage in intrinsic silicon

(a) is positive
(b) is zero
(c) is negative
(d) changes its sign based on application of magnetic field

67. Most outstanding property of indium antimonide is

(a) A very wide range gap
(b) High resistivity at room temperature
(c) High carrier mobility
(d) Very low conductivity at room temperature

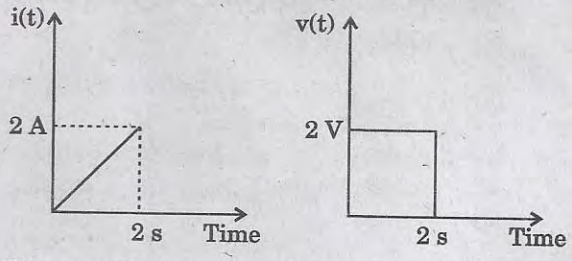
68. Which of the following semiconducting compounds is used in photoconductive devices ?

(a) Caesium antimonide
(b) Barium oxide
(c) Lead sulphide
(d) Zinc oxide

69. A magnetic ring has a mean circumference of 20 cm and a cross-section of 20 cm^2 and has 800 numbers of turns of wire. When the exciting current is 5 A, the flux is 2 mWb. The relative permeability of iron is nearly

(a) 3·98
(b) 398
(c) 0·398
(d) 39·8

70. The voltage and current waveforms for an element are shown in the figures.



The circuit element and its value are

(a) Capacitor and 2 F

(b) Inductor and 1 H

(c) Inductor and 2 H

(d) Resistor and 1 Ω

71. For a series R-C circuit, the power factor corresponding to maximum power is

(a) 0·5 lag

(b) 0·5 lead

(c) 0·707 lag

(d) 0·707 lead

72. The power consumed by a coil is 300 W when connected to a 30 V dc source and 108 W when connected to a 30 V ac source. The reactance of the coil is

(a) 3 Ω

(b) 4 Ω

(c) 5 Ω

(d) 6·67 Ω

73. A conductor of diameter d, length l consumes a power of W when a current I flows through it. What will be the power consumed if d is doubled, l is halved and current is tripled ?

(a) 18 W

(b) 36 W

(c) 48 W

(d) 72 W

74. When a source is delivering maximum power to a load, the efficiency of the circuit is always

(a) 50%

(b) 75%

(c) 100%

(d) Depends on the circuit parameters

75. Consider the following statements :

Any element connected in

1. Series with an ideal current source is redundant.

2. Parallel with an ideal current source is redundant.

3. Series with an ideal voltage source is redundant.

4. Parallel with an ideal voltage source is redundant.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 and 3

(c) 2 only

(d) 1 and 4

76. A battery charger can drive a current of 5 A into a 1 Ω resistance connected at its output terminals. If it is able to charge an ideal 2 V battery at 7 A rate, then Thevenin's equivalent will be

(a) 7·5 V in series with 0·5 Ω

(b) 12·5 V in series with 1·5 Ω

(c) 7·5 V in parallel with 0·5 Ω

(d) 12·5 V in parallel with 1·5 Ω

77. The output power of a filter is 100 mW, when the signal frequency is 5 kHz. When the frequency is increased to 25 kHz, the output power falls to 50 mW. What is the dB change in power ?

(a) – 3 dB

(b) – 5 dB

(c) – 7 dB

(d) – 2 dB

78. The principle of operation used in capacitive transducers to measure level of liquid is change of

(a) Area of plates

(b) Dielectric strength

(c) Distance between plates

(d) Shape of plates

79. In any network the current will be seen to be consisting of a forced current and a natural current. A forced current is

(a) A steady-state current with external source but a natural current is a transient current in a closed circuit with no external source.

(b) A transient current with external source but a natural current is a steady-state current in a closed circuit with no external source.

(c) A steady-state current in a closed circuit without external source, while a natural current is a transient current with an external source.

(d) A transient current in a closed circuit without external source, while a natural current is a steady-state current with an external source.

80. A coil of resistance 10 Ω and inductance 0·8 H is connected to a 200 V dc supply. The initial rate of change of current is

(a) 16 A/s

(b) 160 A/s

(c) 250 A/s

(d) 4000 A/s

81. In moving iron instruments, eddy current damping ***cannot*** be used as

(a) They have a strong operating magnetic field

(b) They are not normally used in vertical position

(c) They need a large damping force, which can only be provided by air friction.

(d) The introduction of a permanent magnet required for eddy current damping would distort the existing weak operating magnetic field

82. A basic D'Arsonval movement showing full scale deflection for a current of 50 μA and having internal resistance of 500 Ω is used as a voltmeter. What is the value of multiplier resistance needed to measure a voltage range of 0 – 20 V ?

(a) 398·5 kΩ

(b) 399 kΩ

(c) 399·5 kΩ

(d) 400 kΩ

83. One single-phase energy meter operating on 230 V and 5 A for 5 hours makes 1940 revolutions. Meter constant is 400 rev/kWh. The power factor of the load is

(a) 1·0

(b) 0·8

(c) 0·7

(d) 0·6

84. In De Sauty Bridge (unmodified form) it is possible to obtain balance

(a) Even if both the capacitors are imperfect

(b) If one of the capacitors is perfect

(c) Only if both the capacitors are perfect

(d) All of the above

85. The current coil of a single-phase energy meter is wound on

(a) One limb of the laminated core

(b) Both the limbs of the laminated core with same number of turns

(c) Both the limbs of the laminated core with different number of turns

(d) The centre of the limb on the laminated core

86. For controlling the vibration of the disc of ac energy meter, damping torque is produced by

(a) Eddy current

(b) Chemical effect

(c) Electrostatic effect

(d) Magnetic effect

87. The meter constant of a single-phase 230 V induction watt hour meter is 400 revolutions per kWh. The speed of the meter disc for a current of 10 A of 0·9 pf lagging will be

(a) 13·80 rpm

(b) 16·02 rpm

(c) 18·20 rpm

(d) 21·10 rpm

88. A galvanometer has a current sensitivity of 1 μA/mm and a critical damping resistance of 1 kΩ. The voltage sensitivity and the meg-ohm sensitivity respectively are

(a) 1 mV/mm and 1 MΩ

(b) 1 mV/mm and 2 MΩ

(c) 2 mV/mm and 2 MΩ

(d) 2 mV/mm and 1 MΩ

89. Electrostatic voltmeters are particularly suitable for measuring high voltages because the construction is simplified due to

(a) Large electrostatic forces

(b) Small electrostatic forces

(c) Large value of current

(d) Small value of current

90. A moving coil instrument of resistance 5 Ω requires a potential difference of 75 mV to give a full scale deflection. The value of shunt resistance needed to give a full scale deflection at 30 A is

(a) 2·5 mΩ

(b) 9·99 mΩ

(c) 5 Ω

(d) 9·95 Ω

91. The function of input attenuators in measuring instruments, like VTVM and CRO, is to

(a) Increase the input impedance

(b) Attenuate the frequency range

(c) Attenuate the input signal amplitude without altering the frequency contents

(d) Attenuate the input impedance

92. With the help of which bridge are the capacitance and dielectric loss of a capacitor generally measured ?

(a) De Sauty

(b) Wien series

(c) Anderson

(d) Schering

93. The deflection of a hot wire instrument depends on

(a) Instantaneous value of alternating current

(b) Average value of current

(c) RMS value of alternating current

(d) Voltage instead of current

94. A DVM uses 10 MHz clock and has a voltage controlled generator which provides a width of 5 μs/volt of unit signal. 10 V input signal would correspond to a pulse count of

(a) 500

(b) 750

(c) 250

(d) 1000

95. A resistance strain gauge with a gauge factor of 2·0 is fastened to a steel member subjected to a stress of 100 N/mm^2. The modulus of elasticity of steel is approximately 2×10^5 N/mm^2. The percentage change in resistance is

(a) 1·50

(b) 1·00

(c) 0·15

(d) 0·10

96. The resistance of 125 Ω strain gauge changes by 1 Ω for 4000 micro-strain. The gauge factor for strain gauge is

(a) 1·5

(b) 2·0

(c) 2·5

(d) 3·0

97. Delay line is essential in a CRO, to ensure that

(a) Vertical signal starts after the retrace period of sweep signal

(b) The sweep reaches the horizontal plates before the desired signal under consideration

(c) Initial part of signal to be observed is not lost

(d) All of the above

98. Which of the following ADC has highest accuracy ?

(a) Successive approximation type

(b) Flash or parallel type

(c) Single slope integration type

(d) Dual slope integration type

99. Consider the following transducers :

1. LVDT
2. Piezoelectric
3. Thermocouple
4. Photovoltaic cell

Which of the above are active transducers ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 2 and 3 only

(d) 2, 3 and 4

100. A unity feedback second order control system is characterized by the open loop transfer function $(s) = \dfrac{K}{s(Js + B)}$.

J = moment of inertia, B = damping constant and K = system gain

The transient response specification which is not affected by system gain variation is

(a) Peak overshoot

(b) Rise time

(c) Settling time

(d) Time to peak overshoot

101. There are no transients in pure resistance circuits because they

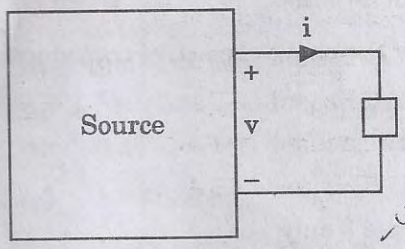
(a) Offer high resistance

(b) Obey Ohm's law

(c) Have no stored energy

(d) Are linear circuits

102. As shown in the figure, 1 Ω resistance is connected across a source that has a load line v + i = 100. The current through the resistance is



(a) 25 A

(b) 50 A

(c) 100 A

(d) 200 A

103. The initial and final values of $f(t) = 15 - 10t - 10e^{-20t}$ are respectively

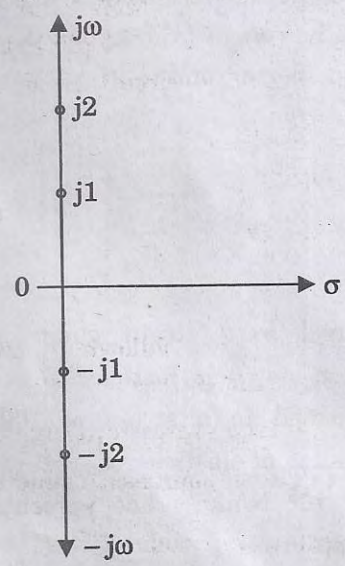
(a) 5 and ∞

(b) 5 and – ∞

(c) 15 and ∞

(d) 15 and 10

104. The pole-zero pattern of a certain filter is shown in figure. The filter must be



(a) Low-pass type

(b) High-pass type

(c) Band-pass type

(d) All-pass type

105. A single-phase ac voltage source has 200 V rms and a system connected consumes an active power of 300 W. What is the reactive power consumed by the system if 2·5 A rms current is drawn ?

(a) 100 VAR

(b) 200 VAR

(c) 300 VAR

(d) 400 VAR

106. The transfer function of a low-pass RC network is

(a) RCs (1 + RCs)

(b) $\frac{1}{(1 + RCs)}$

(c) $\frac{RC}{(1 + RCs)}$

(d) $\frac{s}{(1 + RCs)}$

107. An RLC resonant circuit has a resonance frequency of 1·5 MHz and bandwidth of 10 kHz. If C = 150 pF, then effective resistance of the circuit will be

(a) 29·5 Ω

(b) 14·75 Ω

(c) 9·5 Ω

(d) 4·7 Ω

108. Consider the following two types of non-identical sources :

1. Voltage sources $e_1(t)$ and $e_2(t)$
2. Current sources $i_1(t)$ and $i_2(t)$

Regarding the mode of their connection in a circuit,

(a) 1 cannot be connected in parallel, and 2 cannot be connected in series

(b) 1 cannot be connected in series, and 2 cannot be connected in parallel

(c) Both 1 and 2 cannot be connected in series

(d) Both 1 and 2 cannot be connected in parallel

109. In a series resonant circuit, maximum voltage across L occurs at

(a) Resonant frequency

(b) Slightly below resonant frequency

(c) Slightly above resonant frequency

(d) At a frequency where I is maximum

110. Two wattmeters are used to measure the power in a 3-phase balanced system. What is the power factor of the load when one wattmeter reads twice the other ?

(a) 0

(b) 0·5

(c) 0·866

(d) 1

111. In a balanced 3-phase 200 V circuit, the line current is 115·5 A. When the power is measured by two wattmeter method, one of the wattmeters reads 20 kW and the other one reads zero. What is the power factor of the load ?

(a) 0·5

(b) 0·6

(c) 0·7

(d) 0·8

112. A coil having an inductance of 0·5 H and a resistance of 60 Ω is connected in series with a capacitance of 10 μF. The coil is connected to 100 V ac supply. What is the source frequency and current flowing in the circuit under resonance condition ?

(a) 7·121 Hz and 16·7 A

(b) 7·121 Hz and 1·67 A

(c) 71·21 Hz and 16·7 A

(d) 71·21 Hz and 1·67 A

113. Three equal impedances are first connected in delta across a 3-phase balanced supply. If the same impedances are connected in star across the same supply then,

(a) Phase current will be one-third

(b) Line current will be one-third

(c) Power consumed will be one-third

(d) Phase current will remain the same

114. A Hurwitz polynomial D(s) must satisfy two conditions. One is the polynomial is real when s is real. What is the other condition ?

(a) Roots of D(s) have real parts which are positive and non-zero

(b) Roots of D(s) have imaginary parts which are negative

(c) Roots of D(s) have real parts which are either zero or negative

(d) Roots of D(s) have real parts which are positive or zero

115. The unit impulse response of a system is given as $c(t) = -4e^{-t} + 6e^{-2t}$. The step response of the same system for $t \geq 0$ is equal to

(a) $3e^{-2t} + 4e^{-t} + 1$

(b) $-3e^{-2t} + 4e^{-t} + 1$

(c) $-3e^{-2t} + 4e^{-t} - 1$

(d) $3e^{-2t} - 4e^{-t} + 1$

116. Four ammeters M_1, M_2, M_3 and M_4 with the following specifications are available. (Full scale, accuracy value as percentage of FS)

$M_1 = 20 \pm 0{\cdot}10$; $M_2 = 10 \pm 0{\cdot}20$; $M_3 = 5 \pm 0{\cdot}50$; and $M_4 = 1 \pm 1{\cdot}00$

A current of 1 A is to be measured. To obtain minimum error in the reading one should select meter

(a) M_1

(b) M_2

(c) M_3

(d) M_4

117. In an induction type energy meter, the steady speed attained by the rotating disc is

1. Proportional to the deflecting torque.
2. Proportional to the resistance of the path of eddy currents.
3. Inversely proportional to the effective readings of disc from its axis.
4. Inversely proportional to the square of brake magnet flux.

Which of the above 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

118. Consider the following functions :

1. $\dfrac{(s^2+1)(s^2+3)}{s(s^2+2)}$
2. $\dfrac{s(s^2+1)(s^2+3)}{(s^2+0{\cdot}5)(s^2+2)}$
3. $\dfrac{(s^4+4s^2+3)}{s^2+2s}$
4. $\dfrac{s^5+4s^3+3s}{s^4+2{\cdot}5s+1}$

Which of the above functions are LC driving point impedances ?

(a) 1, 2, 3 and 4

(b) 2 and 3 only

(c) 1 and 2 only

(d) 3 and 4 only

119. A dc voltmeter has a sensitivity of 1000 Ω/V. When it measures half full scale in 100 V range, the current through the voltmeter is

(a) 100 mA

(b) 50 mA

(c) 1 mA

(d) 0·5 mA

120. Two wattmeter method is employed to measure power in a 3-phase balanced system with the current coil connected in the A and C lines. The phase sequence is ABC. If the wattmeter with its current coil in A-phase line reads zero, then the power factor of the 3-phase load will be

(a) Zero lagging

(b) Zero leading

(c) 0·5 lagging

(d) 0·5 leading