089/2024

Maximum : 100 marks

Time : 1 hour and 30 minutes

1. The average power in watts delivered to $Z_L = 8 - j4\,\Omega$ by an ideal current source $i(t) = 4\sin(\omega t + 30°)\ A$ is :

(A) 78 W (B) 32 W

(C) 64 W (D) 0 W

2. A sine wave has a peak value of 20 V. Its peak factor is :

(A) 1.732 (B) 1.11

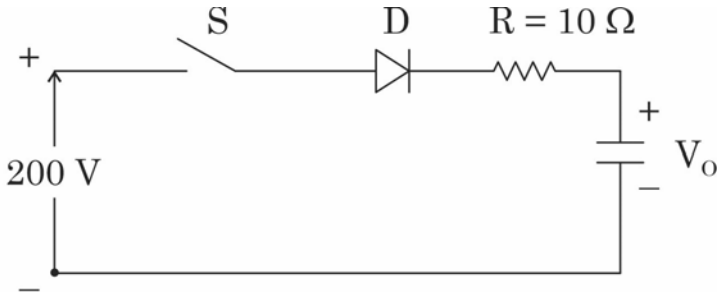
(C) 1.414 (D) 0.707

3. The input voltage to a converter is given by $v(t) = 200\sin(100\pi t)V$ and the current drawn by the converter is given by $i(t) = 10\sin(100\pi t - 60°) + 10\sin(300\pi t + 45°) + 2\sin(700\pi t - 30°)\ A$. The active power drawn by the converter is :

(A) 2300 W (B) 1150 W

(C) 4324 W (D) 500 W

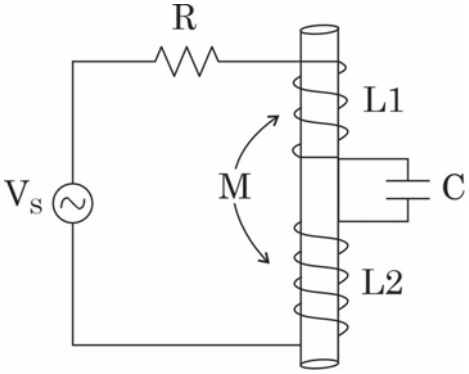
4. The capacitor shown in figure is initially charged to $V_o = 100\,V$ with upper plate positive. Switch is closed at $t = 0$. Current through the circuit at $t = 0$ and final voltage across capacitor are respectively :



(A) 10 A and 200 V (B) 20 A and 100 V

(C) 5 A and 100 V (D) 10 A and 150 V

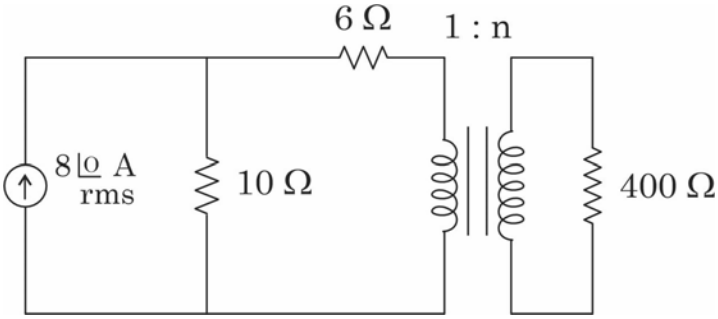
5. The resonant frequency of the circuit in figure given below with parameters $R = 10\ \Omega$, $L1 = L2 = 10$ mH, $M = 5$ mH, $C = 0.03\,\mu$F is :



(A) 2.3 kHz (B) 3.3 kHz

(C) 4.3 kHz (D) 5.3 kHz

6. Find the power delivered to 400 Ω load if $n = 10$:



(A) 24 W (B) 32 W

(C) 64 W (D) 120 W

7. Consider the following statements :

(1) The phase angle between voltage across inductor and voltage across capacitor is 180° for a series RLC circuit.

(2) The current accepted at resonance is maximum in a parallel RLC circuit.

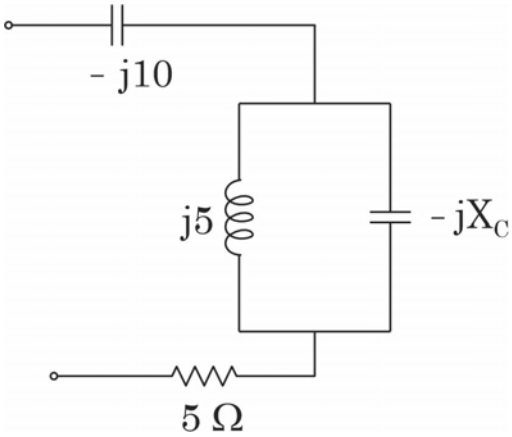
(3) The sum of inductor and capacitor currents is maximum at resonance in a parallel RLC circuit.

Which of the above statements are true?

(A) (1) and (2) (B) (2) and (3)

(C) (3) and (1) (D) Only (1)

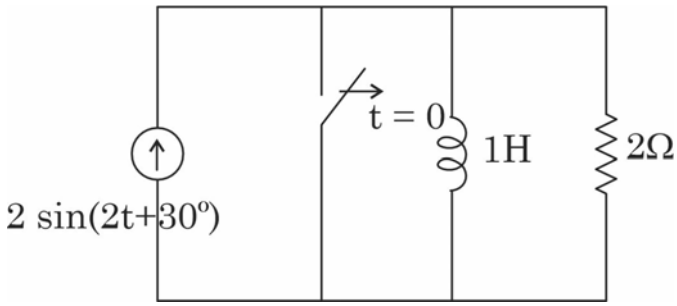
8. What will be the value of X_C so that the circuit is resistive?



(A) 2.5 Ω (B) 5 Ω

(C) 10 Ω (D) 20 Ω

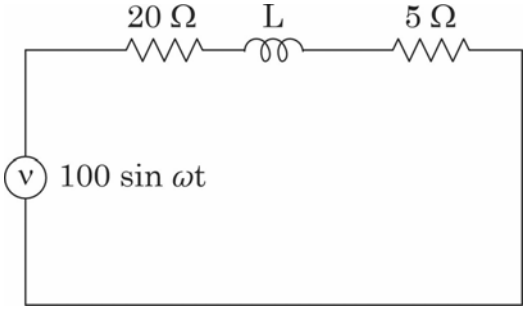
9. In the figure below, the steady state current through inductor is :



(A) $\sqrt{2}\sin 2t$ (B) $2\sqrt{2}\sin 2t$

(C) $\sqrt{2}\sin(2t - 15°)$ (D) $2\sqrt{2}\sin(2t - 15°)$

10. In the RL circuit shown, the power consumed by 20 Ω resistor is given as 80 W. Then the power factor of the circuit is :



(A) 0.45 (B) 0.6

(C) 0.707 (D) 0.8

11. The magnetic flux through a coil of wire can be increased by :

(A) increasing the number of turns in the coil

(B) decreasing the current in the coil

(C) reducing the magnetic permeability of the core

(D) increasing the resistance of the wire

12. The mutual inductance between two coils depends on their :

(A) resistance (B) capacitance

(C) length (D) coupling co-efficient

13. The magnetic field around a current carrying conductor is :

(A) circular (B) linear

(C) elliptical (D) spherical

14. An inductor is connected in series with a resistor in an ac circuit. The phase difference between current and voltage across the resistor is :

(A) 0 degree (B) 45 degree

(C) 90 degree (D) 180 degree

15. Which material is commonly used for the core of an inductor or transformer due to its high permeability?

(A) Aluminium (B) Copper

(C) Silicon (D) Iron

16. The power factor of an inductive circuit can be improved by connecting a :

(A) capacitor in series (B) capacitor in parallel

(C) inductor in series (D) resistor in parallel

17. The magnetic reluctance of a material is directly proportional to :

(A) Magnetic flux (B) Permeability

(C) Cross-sectional area (D) Magnetic field intensity

18. Which of the following is a magnetic insulator?

(A) air (B) copper

(C) iron (D) none of the above

19. Calculate the ratio of inductance of a ring shaped coil with mean diameter 200 mm containing 500 turns is wound on a wooden core and iron core of diameter 200 mm. The current is 5 A and the relative permeability of iron is 600 :

(A) 1 : 3 (B) 1 : 600

(C) 2 : 5 (D) 2 : 600

20. What is the flux density at a point 60 mm in air from a long straight conductor carrying a current of 500 A?

(A) $1.3\times10^{-3}\,T$ (B) $13.3\,T$

(C) $1.67\times10^{-3}\,T$ (D) $2\,T$

21. Polarity of a DC generator can be reversed by :

(A) Reversing the field current

(B) Reversing the direction of rotation

(C) Reversing the field current or reversing the direction of rotation

(D) Reversing the field current and reversing the direction of rotation simultaneously

22. Hysteresis loss in a DC machine depend on :

(A) Maximum value of flux density (B) Volume and grade of iron used

(C) Frequency of magnetic reversal (D) All of the above

23. If the direction of power flow changes, a cumulative compound motor becomes :

(A) Cumulatively compound generator (B) Shunt generator

(C) Series generator (D) Differentially compound generator

24. If the terminal voltage of a DC generator remains the same as the no load terminal voltage, it is a :

(A) Separately excited DC generator (B) Shunt generator

(C) Cumulatively compound generator (D) Differentially compound generator

25. A 230 V, 100 W bulb is connected in series with the primary of a 230/115 V, 5 kVA transformer. If the primary is energised from 230 V supply and the secondary is open, the lamp will have :

(A) Full brightness (B) Poor brightness

(C) Little less than full brightness (D) Flicker

26. In a transformer, maximum voltage regulation occur when the power factor is :

(A) Zero (B) Unity

(C) Leading (D) Lagging

27. The relative speed between stator and rotor fluxes in a three phase induction motor while running. (Ns-synchronous speed, Nr-rotor speed) :

(A) Ns rpm (B) (Ns – Nr) rpm

(C) (Ns + Nr) rpm (D) 0

28. If the mechanical load on a three phase induction motor is increased, its power factor :

(A) Increases (B) Decreases

(C) Remains Constant (D) Becomes zero

29. The advantage of a short pitch winding is :

(A) Suppression of harmonics (B) Low noise

(C) Increased inductance (D) Both (A) and (B)

30. For a constant load, the magnitude of armature current is high for :

(A) Low values of field excitation (B) High values of field excitation

(C) Both (A) and (B) (D) Does not depend on field excitation

31. The octal representation of an integer is $(372)_8$. If this were to be treated as an eight-bit integer in an 8085-based computer, its decimal equivalent is :

(A) 10 (B) 8

(C) –6 (D) –4

32. _____ code is used in digital measuring devices because it reduces the likelihood of errors.

(A) Gray code (B) Binary code

(C) Excess-3 code (D) Octal code

33. Which of the following properties are available in a universal shift register?

(1) Shift Left

(2) Shift Right

(3) Parallel load

(4) Serial load

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

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

34. Assertion (A) : Master-slave flip flop is free from multiple triggering.

Reason (R) : In the master-slave configuration, slave prevents the multiple triggering since its clock signal is inverted.

(A) Both (A) and (R) are 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, (R) is false

(D) (A) is false, (R) is true

35. The resolution of a 4-bit DAC with a range of output voltage from 0-5 V is :

(A) 0.33 V (B) 0.22 V

(C) 0.11 V (D) 0.44 V

36. Which of the following input signal that can be used by slow peripherals to get extra time in order to communicate with 8085?

(A) HOLD (B) HLDA

(C) IO/$\overline{M}$ (D) READY

37. Which interrupt has highest priority in 8085?

(A) TRAP (B) RST7.5

(C) RST6.5 (D) INTR

38. In 8085 microprocessors, which of the following statement is FALSE?

(A) No. of hardware interrupt present in 8085 microprocessor is five

(B) 8085 microprocessor has bidirectional address bus

(C) 8085 microprocessor has bidirectional data bus

(D) Program counter in 8085 microprocessor always holds the address of the next instruction to be fetched

39. In 8085 microprocessor, let the accumulator contain the value 0AH and register C contain the value 05H. After CMP C instruction is executed :

(A) Zero flag will be set and Carry flag will be reset

(B) Zero flag and Carry flag will be set

(C) Zero flag and Carry flag will be reset

(D) Zero flag will be reset and Carry flag will be set

40. What operation is performed during the first T state of every machine cycle in 8085?

(A) INTR interrupt is recognized

(B) Deactivate the chip select signal from memory devices

(C) Low byte address is latched into an external latch using ALE signal

(D) The interrupting source supplies the branch information to the processor through an interrupt vector

41. A power system experiences a corona loss of 1 kW/km/ph at a frequency of 50 Hz. If the frequency is increased to 100 Hz while keeping everything else constant, how much will the corona loss change?

(A) 1.133 kW/km/ph
(B) 2 kW/km/ph
(C) 0.5 kW/km/ph
(D) 1.667 kW/km/ph

42. For a transmission line experiencing severe power surges, what type of relay offers the most accurate and reliable fault detection and isolation?

(A) Mho relay
(B) Reluctance relay
(C) Impedance relay
(D) Reactance Relay

43. A synchronous machine has a per unit impedance of 0.4 at a specific base voltage. If we select a new base voltage that is 2 times higher, what will the new per unit impedance of the machine?

(A) 0.16
(B) 0.1
(C) 0.2
(D) 0.8

44. The Ferranti effect describes a phenomenon in long overhead transmission lines. When is the Ferranti effect most likely to occur?

(A) When the line is heavily loaded
(B) When the line is loaded at upf
(C) When the line is lightly loaded or at no load
(D) When the sending end voltage is much higher than the receiving end voltage

45. A line-to-ground fault occurs on a power system. The current in the faulted phase is measured at 300 A. What will be the zero sequence current in this scenario?

(A) 600 A
(B) 150 A
(C) 0 A
(D) 100

46. A single-line-to-ground fault occurs on a 3-phase system with an ungrounded neutral and a line-to-neutral voltage of 11 kV. To what value will the voltage on the healthy phases most likely to rise?

(A) $\sqrt{2} \times 11$ kV
(B) $\sqrt{3} \times 11$ kV
(C) $1/\sqrt{3} \times 11$ kV
(D) 33 kV

47. What is the critical factor that determines the stability of a power system under small disturbances?

(A) Load power factor
(B) Fault duration
(C) System inertia
(D) Frequency deviation

48. Why does the voltage across the discs of a string of suspension insulators with identical discs differ, even though they are connected in series?

(A) surface leakage current
(B) shunt capacitance to ground
(C) series capacitances
(D) series and shunt capacitances

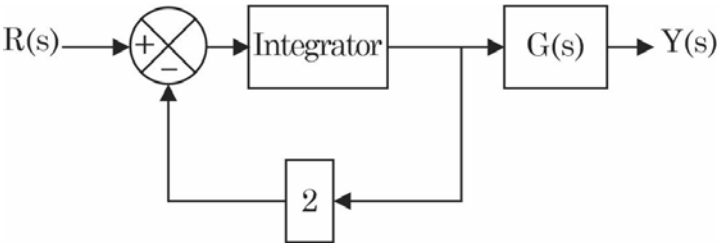
49. String efficiency is an important consideration for designing transmission lines. Why is it important to have a high string efficiency?

(A) It ensures a more uniform distribution of voltage stress across the discs
(B) It minimizes the leakage current to ground
(C) It reduces the overall cost of the transmission line
(D) It increases the maximum voltage that the line can handle

50. SF6 circuit breakers are widely used in high voltage applications. What is the primary reason for this preference over other types of breakers?

(A) SF6 gas is readily available and inexpensive
(B) SF6 breakers are more compact, requiring less space in substations
(C) The superior insulating and arc quenching properties
(D) SF6 breakers require less maintenance compared to other types

51.



If the overall transfer function of system shown in the figure is $\frac{1}{s^3+3s^2+2s}$, then what would be the transfer function of G.

(A) $\frac{1}{s^2+2}$
(B) $\frac{1}{s^2+s}$
(C) $\frac{1}{s^2+s+2}$
(D) $\frac{1}{s^2+3s+2}$

52. A system has two resistors with values of 6 ohm and 10 ohm, respectively and an inductor with a value of 2 henry. A voltage source (V), serving as the system's input, connects these components in series. Determine the transfer function of the system if the voltage across the 6 – ohm resistor is the output :

(A) $\frac{3}{s+8}$
(B) $\frac{s}{s+8}$
(C) $\frac{6}{s+8}$
(D) $\frac{2s}{s^2+16}$

53. The following statements represent the transient performance of two systems :

System A has a settling time of 4 seconds and a peak overshoot of 15%.

System B has a 2 second settling time and a 25% peak overshoot.

Then which of the following statements is true.

(A) System A exhibits faster response and better relative stability

(B) System A exhibits faster response and poorer relative stability

(C) System A exhibits slower response and poorer relative stability

(D) System A exhibits slower response and better relative stability

54. The transfer function of a system is :

$G = \frac{s^2 + 3}{s^3\left(2 + 3s + s^2\right)}$, then

(A) The order of system is 5 and type of system is 2

(B) The order of system is 5 and type of system is 3

(C) The order of system is 3 and type of system is 2

(D) The order of system is 3 and type of system is 5

55. The steady state error of a system to a step input is 0.2. The system is now cascaded with an integrator. Then the steady state error to a ramp input will be :

(A) 0.2 (B) 0.25

(C) 0.5 (D) 1.2

56. A negative feedback closed loop system is being applied with a voltage of 10 V. The system has a forward gain of 5 and a feedback gain of 0.2. The output voltage and the error voltage are :

(A) 50 V, 25 V (B) 50 V, 10 V

(C) 25 V, 10 V (D) 25 V, 5 V

57. The characteristic equation of a closed loop system is $s^4 + 5s^2 + 3s + K = 0$. The value of k that ensures stability of the system is :

(A) $k < 10$ (B) $10 < k < 20$

(C) $k > 15$ (D) $k > 20$

58. A feedback control system's open loop transfer function has a polar plot that intersects the real axis at -5. The system's gain margin (in dB) is (Assume log 5 = 0.698) :

(A) 6.98 (B) –6.98

(C) 13.96 (D) –13.96

59. Which of the following has the advantage of converting the multiplication of gains into addition?

(A) Bode plot
(B) Nyquist plot
(C) Nichols plot
(D) Nichol's chart

60. The elements of first columns of a Routh's table are 1, 3, –0.5, 6, 0.2. It means that :

(A) All the roots are on the right half of s-plane
(B) Only one root is on the right half of s-plane
(C) Two roots are on right half of s-plane
(D) Three roots are on the right half of s-plane

61. The following statements refer to the conditions for successful turn on of an SCR when given a single triggering pulse, when the SCR is connected to an RL load :

(i) SCR should be forward biased.
(ii) SCR should be reverse biased.
(iii) Gate pulse should be applied across Gate and Cathode.
(iv) Gate pulse should be applied across Gate and Anode.
(v) Gate pulse should be present for a minimum time such that the anode current reaches the latching current within that time.
(vi) Gate pulse should be present for a minimum time such that the anode current reaches the holding current within that time.

Choose the correct combination of statements.

(A) (i), (iv) and (v)
(B) (i), (iii) and (vi)
(C) (ii), (iv) and (v)
(D) (i), (iii) and (v)

62. A single–phase fully controlled converter feeding an RL load with back emf 150 V, with single–phase AC source with rms voltage 230 V at 50 Hz as input. If the load is such that the current in the load is discontinuous, what will be the voltage across the load terminals during the period of discontinuity?

(A) 230 V
(B) $230\sqrt{2}\ V$
(C) 150 V
(D) Zero

63. The configuration of a three-phase half-controlled converter has :

(A) 4 SCRs and 1 diode
(B) 2 SCRs and 2 diodes
(C) 3 SCRs and 3 diodes
(D) 3 SCRs and 2 diodes

64. A three-phase fully controlled converter was operating with RL load and continuous load current. The firing angle $\alpha = 60^{\circ}$. During a repair, engineers replaced three thyristors in the bottom side of the converter bridge (i.e., T4, T6 and T2 in the usual naming convention) with diodes :

What change in average output voltage will be observed with the same firing angle?

(A) No change in output voltage
(B) 1.5 times the previous output
(C) 0.5 times the previous output
(D) 2/3 times the previous output

65. Which of the following statements is correct with reference to a Voltage Source Inverter (VSI)?

(A) The DC voltage is unipolar and DC current could be bipolar
(B) The DC voltage could be bipolar and DC current is unipolar
(C) The DC voltage and DC current could be bipolar
(D) The DC voltage and DC current are unipolar

66. The output rms voltage of a single-phase bridge inverter with square wave output requirement, can be varied with :

(A) Variation of DC voltage only
(B) Variation of output pulse width
(C) Variation of both output pulse width and dc voltage
(D) None of the above

67. A single-phase full-bridge voltage source inverter with dc link voltage of 100 V is modulated using Unipolar Sinusoidal PWM. The switching frequency is 5 kHz. The load impedance at fundamental frequency is 10 Ω. The triangular carrier used for the modulation has an amplitude of 4 V and the reference sine wave has an amplitude of 3 V. What is the amplitude of the fundamental component of load current?

(A) 10 A
(B) 7.5 A
(C) 5 A
(D) Data insufficient

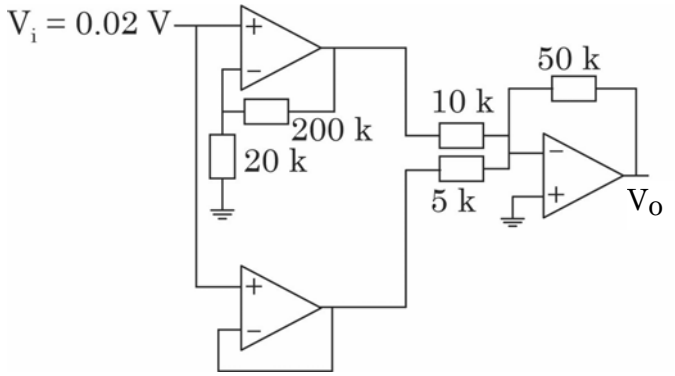
68. For a step-down chopper feeding and RL load with R = 2 Ω, L = 4 mH, f = 1 kHz, duty ratio = 60% and V_{dc} = 48 V. The DC load current is :

(A) 1.44 A
(B) 14.4 A
(C) 40 A
(D) 9.6 A

69. A sinusoidal signal with amplitude 20 mV is applied to the input of an inverting amplifier based on an opamp. The feedback path resistance is 250 kΩ and the input side resistance is 10 kΩ. The slew rate of the opamp is 0.5 V/μs. What is the maximum frequency of the input signal with the given amplitude that may be used without output distortion?

(A) 10^6 rad/s
(B) 0.96×10^6 rad/s
(C) 10^6 Hz
(D) 0.96×10^6 Hz

70. The circuit below shows an amplifier with input voltage V_i = 0.02 V. The output voltage of the amplifier V_O is :



(A) 1.3 V (B) 0.8 V

(C) –1.3 V (D) –1.2 V

71. The ratio of difference between measured value and true value to the true value of a value under measurement is?

(A) Percentage limiting error (B) Percentage error

(C) Absolute error (D) Relative static error

72. Which of the following is the fixed coil in an electrodynamometer type wattmeter?

(A) Current coil (B) Pressure coil

(C) Voltage coil (D) Both current and voltage coils

73. An energy meter can be best categorized as an instrument of :

(A) Indicating type (B) Primary type

(C) Recording type (D) Integrating type

74. What value is typically expected while measuring a quantity using a PMMC instrument?

(A) Average value (B) RMS value

(C) Mean square value (D) Square value

75. The pressure coil of a wattmeter should be connected on the supply side and current coil is connected on the load side, when?

(A) Load impedance is high (B) Load impedance is low

(C) Low supply voltage (D) Load current is high

76. The current under measurement is given by $i = 2 + 4\sin(314t)$ A. If measured using a moving iron instrument, what can be the value shown?

(A) 2 A (B) 4 A

(C) 2.82 A (D) 3.46 A

77. Which of the following instrument has the least loading effect on the circuit under measurement?

(A) PMML
(B) CRO
(C) Electrostatic
(D) Electrodynamometer

78. What are the two measurements that can be carried out using Lissajous figure?

(A) Amplitude and frequency
(B) Amplitude and phase
(C) Frequency and phase
(D) Frequency and Time period

79. The constant load current for a 230 V single phase energy meter is 10 A at unity power factor. If the meter makes 2300 revolutions in 2 hours. What will be the meter constant?

(A) 250 revolutions/kWh
(B) 500 revolutions/kWh
(C) 2300 revolutions/kWh
(D) 1150 revolutions/kWh

80. What should be the value of shunt resistance required to extend the range of a 10A ammeter so that it could measure 100A. Consider the internal resistance of ammeter to be 0.09 Ω?

(A) 0.01 Ω
(B) 0.001 Ω
(C) 0.1 Ω
(D) 1 Ω

81. Which of the following statement best defines a signal?

(A) Signal is a physical quantity that varies with time
(B) Signal is a physical quantity that varies with time and space
(C) Signal is a physical quantity that varies with time, space or any other independent variables
(D) Signal is a physical quantity that varies with time, space or any other independent or dependent variables

82. Find the fundamental period of the signal $X(t) = je^{j10t}$:

(A) $\pi/5$ sec
(B) $\pi/10$ sec
(C) 0.1 sec
(D) None of the above

83. Which of the following function is a periodic signal?

(A) $X(t) = e^{-|t|}$
(B) $X(t) = \sin 10\pi t\ u(t)$
(C) $X(t) = 2\ u(t) + 2\sin(2t)$
(D) $X(t) = 4\cos 5\pi t$

84. Find the fundamental period of the following signal :
$X(t) = 7\cos(5t+7) + 9\sin(6t+9)$

(A) $5/6\pi$
(B) 11π
(C) 2π
(D) Cannot be determined

85. For an energy signal which of the following is true :

(A) $E = 0$ (B) $P = 0$

(C) $E = \infty$ (D) $P = \infty$

86. The system represented by $y(n) = 5x(n) + 3x(n-2) + x(n+3)$ is :

(A) Static and Causal (B) Dynamic and Causal

(C) Static and non Causal (D) Dynamic and non-Causal

87. If a signal $x(t)$ has energy E the energy of signal $x(2t)$ is :

(A) E (B) $2E$

(C) $E/2$ (D) $4E$

88. The value of the function $\int_{-\infty}^{+\infty} e^{-t}\delta(2t-2)dt$ where $\delta(t)$ is an impulse function is :

(A) $2/e$ (B) $1/2e$

(C) $1/e^2$ (D) $1/2e^2$

89. In a sample and hold circuit the time required for conversion of analog to digital is _____ to the duration of hold mode.

(A) Greater (B) Less than

(C) Equal (D) Greater than or equal to

90. Determine the Nyquist rate for the following signal :

$x(t) = 1 + \cos 2000\pi t + \sin^2 4000\pi t$

(A) 4000 π (B) 8000 π

(C) 16,000 π (D) 12,000 π

91. Calculate the illuminance on a surface 5 meters away from a lamp emitting 1500 lumens.

(A) 60 (B) 12

(C) 300 (D) 120

92. A point source of light emits 500 lumens. What is the luminous intensity of the source?

(A) 125 candela (B) 40 candela

(C) 100 candela (D) 50 candela

93. If two 12V batteries each with a capacity of 150 Ah are connected in parallel, what is the total capacity in Ah?

(A) 150 Ah (B) 75 Ah

(C) 300 Ah (D) 200 Ah

94. If an LVDT has an output voltage range of ±10 V for a displacement range of ±10 mm, what is the sensitivity of the LVDT in V/mm?

(A) 0.1 V/mm (B) 2 V/mm

(C) 1 V/mm (D) 0.5 V/mm

95. A Hall effect transducer is used to measure the strength of a magnetic field. The transducer has a Hall coefficient of 5×10^{-5} m^3/C and a thickness of 0.2 mm. If the magnetic field strength is 0.5 T and the current through the transducer is 15 mA, what is the Hall voltage?

(A) 1.875 mV (B) 1.75 mV

(C) 7.5 mV (D) 15 mV

96. A Hall effect transducer is used to measure a magnetic field. If the Hall voltage generated is 2.5 mV when the magnetic field strength is 0.5 T and the current flowing through the sensor is 10 mA, what is the sensitivity of the Hall effect transducer?

(A) 1 mV/T (B) 0.5 mV/T

(C) 25 mV/T (D) 1.25 mV/T

97. Which type of earthing is commonly used in homes?

(A) Plate earthing (B) Earthing mat

(C) Rod earthing (D) Strip earthing

98. If a 20-meter-long copper wire has a resistance of 0.03 ohms, what is the resistance of a 60-meter-long wire of the same type and thickness?

(A) 0.01 Ω (B) 0.09 Ω

(C) 0.06 Ω (D) 0.015 Ω

99. A rotary potentiometer is used as an angular displacement transducer. If the total resistance of the potentiometer is 20 kΩ and the angular displacement is 90°, what is the resistance change for this displacement, assuming a linear relationship?

(A) 5 KΩ (B) 2.5 KΩ

(C) 10 KΩ (D) 1 KΩ

100. How many 3.7 V, 3000 mAh lithium-ion cells are needed to create a 22.2 V battery pack with a capacity of 6000 mAh?

(A) 6 cells in parallel

(B) 6 cells in series

(C) 12 cells (6 cells in series and 2 in parallel)

(D) 24 cells (12 cells in series and 2 in parallel)

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