# 104/2026-E

Question Booklet Alpha Code: **A**

Question Booklet Serial Number: 100013

Total No. of questions : 100 Time : 75 Minutes

Maximum : 100 Marks

## INSTRUCTIONS TO CANDIDATES

1. The question paper will be given in the form of a Question Booklet. There will be four versions of question booklets with question booklet alpha code viz. A, B, C & D.
2. The Question Booklet Alpha Code will be printed on the top left margin of the facing sheet of the question booklet.
3. The Question Booklet Alpha Code allotted to you will be noted in your seating position in the Examination Hall.
4. If you get a question booklet where the alpha code does not match to the allotted alpha code in the seating position, please draw the attention of the Invigilator IMMEDIATELY.
5. The Question Booklet Serial Number is printed on the top right margin of the facing sheet. If your question booklet is un-numbered, please get it replaced by new question booklet with same alpha code.
6. The question booklet will be sealed at the middle of the right margin. Candidate should not open the question booklet, until the indication is given to start answering.
7. Immediately after the commencement of the examination, the candidate should check that the question booklet supplied to him contains all the 100 questions in serial order. The question booklet does not have unprinted or torn or missing pages and if so he/she should bring it to the notice of the Invigilator and get it replaced by a complete booklet with same alpha code. This is most important.
8. A blank sheet of paper is attached to the question booklet. This may be used for rough work.
9. **Please read carefully all the instructions on the reverse of the Answer Sheet before marking your answers.**
10. Each question is provided with four choices (A), (B), (C) and (D) having one correct answer. Choose the correct answer and darken the bubble corresponding to the question number using Blue or Black Ball-Point Pen in the OMR answer sheet.
11. **Each correct answer carries 1 mark and for each wrong answer 1/3 mark will be deducted. No negative mark for unattended questions.**
12. No candidate will be allowed to leave the examination hall till the end of the session and without handing over his/her Answer Sheet to the Invigilator. Candidates should ensure that the Invigilator has verified all the entries in the Register Number Coding Sheet and that the Invigilator has affixed his/her signature in the space provided.
13. Strict compliance of instructions is essential. Any malpractice or attempt to commit any kind of malpractice in the Examination will result in the disqualification of the candidate.

SEAL

# 104/2026-E

Maximum : 100 marks

Time : 1 hour and 15 minutes

1. A homeowner installs a 1500 W, 230 V rated water heater. Due to poor wiring in the house, the actual voltage at the heater terminals drops to 207 V. The homeowner complains that the water is taking longer to heat than expected. By approximately how much does the heater's actual power output reduce compared to its rated value?

   (A) 10% (B) 15%

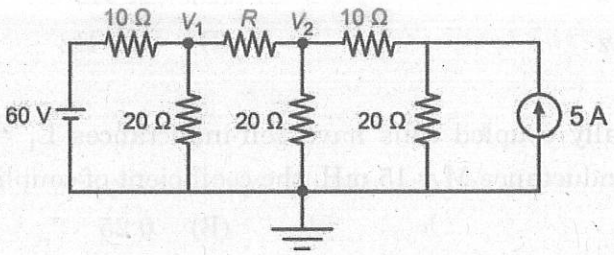
   (C) 19% (D) 25%

2. The energy stored in a capacitor of capacitance C farads charged to a voltage V volt is :

   (A) CV joules (B) $\frac{1}{2}$ CV joules

   (C) $CV^2$ joules (D) $\frac{1}{2}$ $CV^2$ joules

3. In the circuit shown below, $V_1 = 40\,V$ when R is 10 Ω. When R is zero, the value of $V_2$ will be :




   (A) 40 V (B) 30 V

   (C) 20 V (D) 0 V

4. The form factor of a pure sinusoidal alternating current is :

   (A) 1.0 (B) 1.11

   (C) 1.414 (D) 1.732

5. Consider the following :

   Energy storage capability of basic passive elements is that :

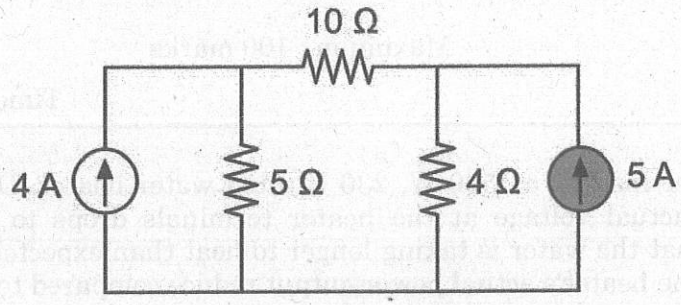
   1. Resistance dissipates energy
   2. Capacitance stores energy
   3. Inductance dissipates energy

   Which of the above is/are correct?

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

   (C) 3 alone (D) 1 and 2

6. In the circuit shown in the given figure, power dissipated in the 5 Ω resistor is :




(A) 0
(B) 80W
(C) 125W
(D) 405W

7. Three resistors of 9 Ω each are connected in a delta configuration. The equivalent resistance of each arm in the star equivalent circuit is :

(A) 1 Ω
(B) 2 Ω
(C) 3 Ω
(D) 27 Ω

8. A series RLC circuit has a resonant frequency of 1000 Hz and a quality factor Q = 50. The bandwidth of the circuit is :

(A) 20 Hz
(B) 10 Hz
(C) 50 Hz
(D) 100 Hz

9. Two magnetically coupled coils have self-inductances $L_1$ = 40 mH and $L_2$ = 90 mH. If the mutual inductance M = 15 mH, the coefficient of coupling k is :

(A) 0.15
(B) 0.25
(C) 0.375
(D) 0.50

10. A circuit has a 24 V source and two resistors in series: 6 Ω and 12 Ω. Using Thevenin's theorem, the open-circuit voltage (Vth) across the 12 Ω resistor is :

(A) 8 V
(B) 12 V
(C) 16 V
(D) 24 V

11. Faraday's law of electromagnetic induction states that the magnitude of the induced EMF in a circuit is proportional to :

(A) The magnitude of the magnetic field
(B) The current flowing in the circuit
(C) The resistance of the circuit
(D) The rate of change of flux linkage with the circuit

12. An engineer is designing an electromagnetic lifting crane used in a scrapyard to lift steel plates. To increase the lifting force, he increases the current through the coil wound around the iron core. However, when the current is suddenly switched OFF, a spark appears across the switch terminals.

Which principle best explains the appearance of the spark?

(A) The iron core retains magnetic potential and releases it as heat

(B) A dynamically induced emf is produced because the conductor moves in a magnetic field

(C) A statically induced emf is produced that opposes the decrease in current according to Lenz's law

(D) The magnetic field strength becomes zero instantly, producing electric charges

13. A toroidal core has a mean length of 0.5 m, cross-sectional area of 4 $cm^2$, and relative permeability $\mu_r = 800$. The reluctance of the core is approximately : ($\mu_0 = 4\pi \times 10^{-7}$ H/m)

(A) $0.124 \times 10^6$ AT/Wb (B) $0.0124 \times 10^6$ AT/Wb

(C) $12.4 \times 10^6$ AT/Wb (D) $1.24 \times 10^6$ AT/Wb

14. A statically induced EMF (as in a transformer) differs from a dynamically induced EMF (as in a generator) in that :

(A) Statically induced EMF requires physical motion of conductors

(B) Dynamically induced EMF is produced by varying flux with stationary conductors

(C) Statically induced EMF is produced by change of flux linking with stationary conductors

(D) Both are identical in origin

15. The energy stored in an inductor of 200 mH when carrying a steady current of 5 A is :

(A) 0.5 J (B) 1.0 J

(C) 2.5 J (D) 5.0 J

16. A coil of 500 turns links a flux of 0.02 Wb. The flux is uniformly reduced to zero in 50 milliseconds. The average EMF induced in the coil is :

(A) 100 V (B) 500 V

(C) 400 V (D) 200 V

17. A conductor of effective length 0.8 m moves at a velocity of 25 m/s at an angle of 60° to a uniform magnetic field of flux density 1.5 T. The EMF induced in the conductor is :

(A) 7.5 V (B) 15.0 V

(C) 26.0 V (D) 30.0 V

18. For a wave-wound DC generator with P poles, the number of parallel paths A in the armature is always :

(A) A = 1 (B) A = 2

(C) A = P (D) A = P/2

19. The back EMF developed in a running DC motor is caused by :

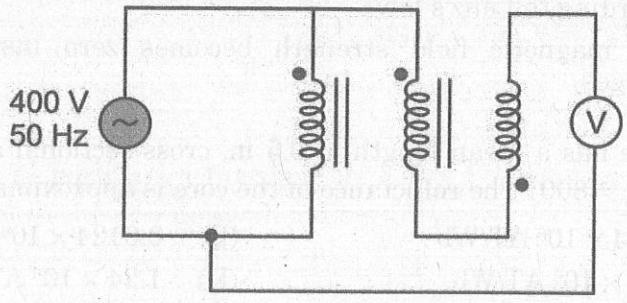
(A) Armature winding resistance drop

(B) Brush contact voltage drop

(C) Field winding excitation voltage

(D) The armature rotating in the magnetic field

20. A 400 V/200 V/200 V, 50 Hz three-winding transformer is connected as shown in the figure below.




The reading of the voltmeter V will be :

(A) –400 V (B) 800 V

(C) 600 V (D) 0 V

21. The synchronous speed of a 3-phase, 4-pole, 50 Hz induction motor is :

(A) 750 rpm (B) 1000 rpm

(C) 1500 rpm (D) 3000 rpm

22. Four types of d.c. generators of constant speed are considered (List-I). Their external characteristics at constant speed are given in List-II. Match List-I (Type of d.c. generator) with List-II (External Characteristics) and select the correct answer using the codes given below the lists :

List-I

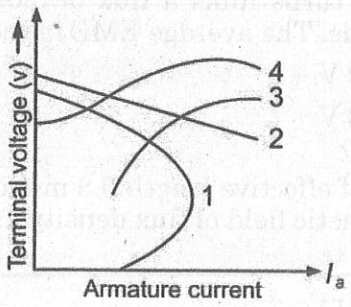
(a) Separately excited

(b) Series excited

(c) Shunt excited

(d) Over-compound excited

List-II




| | (a) | (b) | (c) | (d) |
|---|---|---|---|---|
| (A) | 2 | 3 | 1 | 4 |
| (B) | 1 | 4 | 2 | 3 |
| (C) | 1 | 3 | 2 | 4 |
| (D) | 2 | 4 | 1 | 3 |

23. A 6-pole lap-wound DC generator has 300 armature conductors, flux per pole of 0.05 Wb, and runs at 800 rpm. The generated EMF is :

(A) 100 V (B) 150 V

(C) 200 V (D) 250 V

24. The condition for maximum efficiency in a DC generator is :

(A) Iron losses equal eddy current losses

(B) Variable losses equal constant losses

(C) Copper loss equals zero

(D) Field copper loss equals armature copper loss

25. A 1000 kVA distribution transformer has been supplying a hospital complex and currently runs at 35 - 40% load due to energy conservation measures. A load audit also reveals that the peak demand recorded only during emergency generator switchover tests briefly touches 920 kVA. The junior engineer recommends downsizing to a 400 kVA unit to improve efficiency. What is the correct engineering decision?

(A) Downsize to 400 kVA: Since 35 - 40% is the sustained operating load, a smaller transformer will run closer to its efficiency peak and the brief 920 kVA peak can be handled by the emergency generator

(B) Retain the 1000 kVA unit: Because transformer efficiency is calculated at full load, and only a fully loaded transformer operates at maximum efficiency

(C) Retain the 1000 kVA unit: Because the 920 kVA recorded peak demand would overload a 400 kVA unit, and in a hospital, losing supply during a peak event is a life-safety risk

(D) Downsize to 400 kVA: Transformer efficiency is not a design concern in hospitals; only voltage regulation matters for sensitive medical equipment

26. A 3-phase, 6-pole, 50 Hz induction motor runs at 950 rpm. The frequency of the rotor current is :

(A) 2.5 Hz (B) 5.0 Hz

(C) 25 Hz (D) 50 Hz

27. The Open Circuit (OC) test on a transformer is conducted to determine :

(A) Copper losses and winding resistance

(B) Core (iron) losses and no-load parameters

(C) Short circuit impedance

(D) Efficiency at full load

28. A 15 kW, 220 V DC shunt motor is driving a centrifugal pump in a water treatment plant. During routine maintenance, a technician notices that the field rheostat has accidentally been set to maximum resistance, significantly weakening the field flux. Before the issue is corrected, which of the following consequences is the plant engineer most likely to observe, and why?

(A) The motor overspeeds dangerously, and armature current rises sharply due to reduced back EMF

(B) The motor slows down drastically and stalls due to insufficient torque

(C) The motor runs at reduced speed with lower armature current, reducing pump output

(D) The motor operates normally since a centrifugal pump load automatically compensates for field weakening

29. A 220 V DC shunt motor has an armature resistance of 0.4 Ω. At no load, the armature current is 5 A. The back EMF at no load is :

(A) 218 V (B) 220 V

(C) 222 V (D) 200 V

30. A 5 kVA, 200/400 V single-phase transformer has an iron loss of 100 W and a full-load copper loss of 150 W. The efficiency at full load, unity power factor is :

(A) 93.5% (B) 97.1%

(C) 96.2% (D) 95.2%

31. A 3-phase induction motor has a rotor input (air-gap power) of 60 kW and runs at a slip of 5%. The mechanical power developed by the rotor is :

(A) 54 kW (B) 57 kW

(C) 58 kW (D) 60 kW

32. A synchronous motor operates at a leading power factor when it is :

(A) Under-excited

(B) Connected to a lagging power factor load

(C) Running at no load with rated excitation

(D) Over-excited

33. A three-phase alternator has 12 poles and rotates at 500 rpm. The frequency of the generated EMF is :

(A) 25 Hz (B) 50 Hz

(C) 60 Hz (D) 100 Hz

34. Assertion [A] : The generator with more drooping characteristic carries small load.
Reason [R] : The generator having more drooping characteristic delivers less current than the current delivered by the generator having less drooping characteristic.

(A) Both [A] and [R] are true and [R] is a correct explanation of [A]
(B) Both [A] and [R] are true but [R] is not a correct explanation of [A]
(C) Both [A] and [R] are false
(D) [A] is false but [R] is true

35. The synchronous condenser is essentially a synchronous motor running at no load and is used in power systems primarily to :

(A) Control reactive power and improve power factor
(B) Deliver real (active) power to the grid
(C) Act as a starting mechanism for induction motors
(D) Reduce system frequency deviations

36. A 3-phase, 400 V, 50 Hz, 6-pole slip-ring induction motor drives a loaded conveyor belt in a cement factory. The engineer needs to reduce the conveyor speed to 60% of its current value for a different product grade, while maintaining the same load torque. Two methods are proposed :

(i) add external resistance in the rotor circuit
(ii) reduce supply voltage to 60%.

Which method should the engineer choose, and what is the critical reason?

(A) Add rotor resistance: It maintains rated torque capability while achieving the required speed reduction without risking motor stall
(B) Reduce supply voltage: It is simpler and avoids rotor heating losses
(C) Both methods are equivalent in performance: Choose based on cost
(D) Reduce supply voltage: Torque is proportional to voltage, so the same torque is maintained

37. A three-phase induction motor running at 3% slip with a rotor input power of 40 kW. The rotor copper loss is :

(A) 0.4 kW (B) 38.8 kW
(C) 3.2 kW (D) 1.2 kW

38. The binary equivalent of the decimal number 45 is :

(A) 101100 (B) 101101
(C) 101010 (D) 101001

39. The Gray code equivalent of the binary number 1010 is :

(A) 1111 (B) 1100
(C) 1101 (D) 1011

40. The Excess-3 (XS-3) code representation of decimal digit 6 is :

(A) 0110 (B) 1001

(C) 0011 (D) 1111

41. A full adder circuit has inputs A = 1, B = 1, and Carry-in Cin = 1. The Sum (S) and Carry-out (Cout) are:

(A) S = 1, Cout = 1 (B) S = 0, Cout = 0

(C) S = 0, Cout = 1 (D) S = 1, Cout = 0

42. A 4-to-1 multiplexer (MUX) selects one of four inputs to the output. The number of select (address) lines required is:

(A) 1 (B) 4

(C) 3 (D) 2

43. The ASCII (American Standard Code for Information Interchange) code of the character 'A' in hexadecimal is :

(A) 41H (B) 61H

(C) 30H (D) 20H

44. A JK flip-flop is in the TOGGLE mode (J = 1, K = 1). If the present state Q = 0, after one active clock edge, Q becomes :

(A) 0 (B) 1

(C) Indeterminate (D) High impedance

45. The decimal equivalent of the hexadecimal number $(2AF)_{16}$ is :

(A) 527 (B) 639

(C) 687 (D) 703

46. In the 8085 microprocessor, the number of address lines and the maximum addressable memory are :

(A) 8 address lines, 256 bytes (B) 8 address lines, 64 KB

(C) 16 address lines, 128 KB (D) 16 address lines, 64 KB

47. In the 8085 instruction set, the addressing mode in which the operand data is specified directly within the instruction itself (not its address) is called :

(A) Register addressing (B) Direct addressing

(C) Immediate addressing (D) Indirect addressing

48. The charging current in a long EHV transmission line is primarily due to :

(A) Line resistance

(B) Line inductance

(C) Line capacitance (shunt capacitance)

(D) Load current

49. $SF_6$ (Sulphur hexafluoride) circuit breakers are preferred in high-voltage switchgear primarily because :

(A) $SF_6$ is inexpensive and easily available

(B) $SF_6$ has excellent arc-quenching properties and very high dielectric strength

(C) $SF_6$ is non-flammable and operates at atmospheric pressure

(D) $SF_6$ does not require any maintenance

50. The string efficiency of a suspension insulator string with 3 discs (top disc voltage $V_1$, middle $V_2$, bottom $V_3$) is defined as :

(A) $(V_1+V_2+V_3)/(3\times V_3)\times 100\%$ (B) $V_3/(V_1+V_2+V_3)\times 100\%$

(C) $V_1/(V_1+V_2+V_3)\times 100\%$ (D) $(3\times V_1)/(V_1+V_2+V_3)\times 100\%$

51. The method of symmetrical components is primarily employed for the analysis of :

(A) Balanced three-phase load flow

(B) Unsymmetrical (unbalanced) faults such as single line-to-ground and line-to-line faults

(C) Steady-state stability studies

(D) Transient stability problems

52. Corona loss on overhead transmission lines increases significantly when :

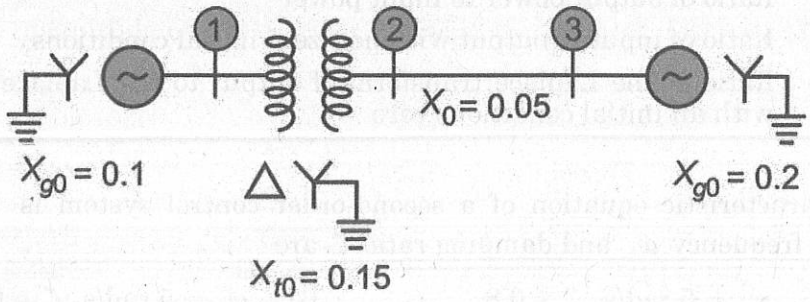
(A) Conductor diameter is increased

(B) Spacing between conductors is increased

(C) Atmospheric air density increases

(D) Line voltage exceeds the critical disruptive voltage

53. The zero sequence reactance (in pu) are indicated in the network shown in figure below. The zero sequence driving-point reactance of node-3 will be :




(A) 0.05 pu (B) 0.2 pu

(C) 0.1 pu (D) 0.3 pu

54. For a lossless transmission line with inductance L = 2 mH/km and capacitance C = 0.01 μF/km, the surge (characteristic) impedance is approximately :

(A) 200 Ω
(B) 316 Ω
(C) 447 Ω
(D) 632 Ω

55. The maximum power that can be transmitted over a lossless transmission line connecting a sending-end bus (Vs) and a receiving-end bus (Vr) through a series reactance X is :

(A) VsVr / X
(B) VsVr sin $\delta$ / X
(C) $Vs^2$ / 2X
(D) $Vr^2$ / X

56. The Buchholz relay is used for the protection of :

(A) Overhead transmission lines
(B) Busbars at substations
(C) Oil-immersed power transformers
(D) Three-phase induction motors

57. A synchronous generator with subtransient reactance $X''$ = 0.2 pu has a pre-fault terminal voltage of 1.0 pu. A three-phase bolted fault occurs at the terminals.

The initial subtransient fault current is:

(A) 5 pu
(B) 2 pu
(C) 10 pu
(D) 0.2 pu

58. A closed-loop (feedback) control system is one in which :

(A) The control action is independent of the output
(B) The output is fed back and compared with the reference input to generate an error signal
(C) There is no feedback path from output to input
(D) The reference input varies continuously

59. The transfer function of a Linear Time-Invariant (LTI) system is defined as :

(A) Ratio of output to input in the time domain
(B) Ratio of output power to input power
(C) Ratio of input to output with non-zero initial conditions
(D) Ratio of the Laplace transform of output to the Laplace transform of input, with all initial conditions zero

60. The characteristic equation of a second-order control system is $s^2 + 8s + 25 = 0$. The natural frequency $\omega_n$ and damping ratio $\zeta$ are :

(A) $\omega_n$ = 5 rad/s, $\zeta$ = 0.8
(B) $\omega_n$ = 5 rad/s, $\zeta$ = 0.4
(C) $\omega_n$ = 25 rad/s, $\zeta$ = 0.16
(D) $\omega_n$ = 5 rad/s, $\zeta$ = 1.6

61. Mason's Gain Formula is used to determine the overall gain of :

(A) Block diagram reduction (B) Signal flow graphs

(C) Time domain analysis (D) Frequency domain analysis

62. A Type-1 control system (in terms of the number of integrations in the open-loop transfer function) has:

(A) Exactly one open-loop pole at the origin

(B) No open-loop poles at the origin (s = 0)

(C) Two open-loop poles at the origin

(D) One open-loop zero at the origin

63. The Gain Margin (GM) of a stable minimum-phase system, expressed in dB, is :

(A) Negative (less than 0 dB) (B) Zero (exactly 0 dB)

(C) Positive (greater than 0 dB) (D) Infinite for all stable systems

64. Apply Routh's stability criterion to the characteristic equation: $s^3 + 2s^2 + 3s + 6 = 0$. The system is :

(A) Absolutely stable (B) Marginally stable

(C) Unstable (D) Conditionally stable

65. For a unity feedback system with open-loop transfer function G(s) = K /[s(s+2)(s+4)], the value of K for the system to be marginally stable (using Routh's criterion) is :

(A) 8 (B) 16

(C) 24 (D) 48

66. The steady-state error of a Type-0 unity feedback system for a unit ramp input r(t) = t is :

(A) Zero (B) 1/(1 + Kp)

(C) 1/Kv (D) Infinite

67. The Bode plot magnitude of the transfer function $G(j\omega) = 1/[j\omega(1 + j0.1\omega)]$ has a slope (in dB/decade) at very high frequencies ($\omega >> 10\ rad/s$) of :

(A) –20 dB/decade (B) –40 dB/decade

(C) +20 dB/decade (D) 0 dB/decade

68. An SCR (Silicon Controlled Rectifier) is a four-layer device with :

(A) 2 junctions and 2 terminals (B) 3 junctions and 3 terminals

(C) 4 junctions and 3 terminals (D) 4 junctions and 4 terminals

69. The holding current of an SCR is defined as :

(A) The gate current required to trigger the SCR into conduction

(B) The minimum anode current required to keep the SCR in the ON (conducting) state

(C) The maximum anode current the SCR can safely conduct

(D) The anode current at which the SCR enters the forward blocking region

70. A single-phase half-wave controlled rectifier is supplied from a 230 V (rms), 50 Hz source with a resistive load. At firing angle $\alpha = 0^\circ$, the average output DC voltage is approximately :

(A) 77.7 V (B) 207.0 V

(C) 155.0 V (D) 103.5 V

71. The output voltage ripple frequency of a single-phase fully controlled bridge converter (full converter) supplied from a 50 Hz AC source is :

(A) 25 Hz (B) 50 Hz

(C) 100 Hz (D) 200 Hz

72. The CMRR (Common Mode Rejection Ratio) of an ideal operational amplifier is :

(A) Zero (B) Unity (1)

(C) 1000 (60 dB) (D) Infinity

73. A single-phase H-bridge (full-bridge) voltage source inverter with DC bus voltage Vdc can produce output voltages of :

(A) Only +Vdc (single polarity) (B) +Vdc and –Vdc (bipolar)

(C) +Vdc, 0 and –Vdc (three-level) (D) Only sinusoidal AC output

74. A four-quadrant DC chopper is used for :

(A) Speed control in both directions with motoring and regenerative braking

(B) Speed control in one direction only (motoring)

(C) Regenerative braking only

(D) Power factor correction in AC systems

75. The output ripple voltage frequency of a 3-phase fully controlled bridge rectifier (6-pulse converter) supplied from a 50 Hz, 3-phase AC source is :

(A) 50 Hz (B) 100 Hz

(C) 150 Hz (D) 300 Hz

76. In a class-A SCR commutation circuit, forced commutation is achieved by :

(A) Reducing gate current to zero

(B) Reversing the anode-to-cathode voltage using a pre-charged commutating capacitor

(C) Increasing the holding current beyond the anode current

(D) Short-circuiting the gate to cathode

77. Pulse Width Modulation (PWM) in inverters is primarily used to :

(A) Increase the DC bus voltage

(B) Convert three-phase AC to DC

(C) Increase the switching losses

(D) Control the output voltage magnitude and frequency while reducing harmonic content

78. The electrodynamometer (dynamometer) type wattmeter is suitable for measuring power in :

(A) DC circuits only (B) AC circuits only

(C) Both DC and AC circuits (D) Three-phase circuits only

79. The deflection of a moving iron ammeter is proportional to :

(A) Peak value of current

(B) Average value of current

(C) RMS value of current

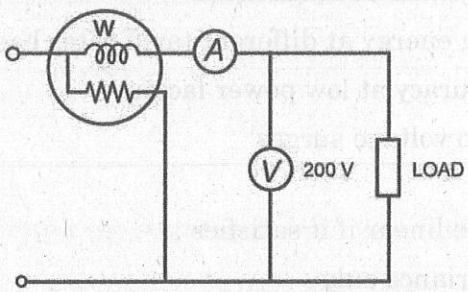
(D) Instantaneous value of current

80. A voltmeter has a full-scale deflection of 100 V and a sensitivity of 1000 Ω/V. The total internal resistance of the voltmeter is :

(A) 1000 Ω (B) 10 kΩ

(C) 100 kΩ (D) 1 MΩ

81. Consider the following data for the circuit shown below :




| | |
|---|---|
| Ammeter | Resistance 0.2 Ω; Reading 5.0 A |
| Voltmeter | Resistance 2 kΩ; Reading 200 V |
| Wattmeter | Current coil resistance 0.2 Ω, Pressure coil resistance 2 kΩ |
| Load | Power factor =1 |

The reading of the Wattmeter is:

(A) 980 W (B) 1000 W

(C) 1005 W (D) 1010 W

82. In the two-wattmeter method of measuring 3-phase balanced power, when the load power factor is exactly 0.5 (lagging), which statement is correct?

(A) Both wattmeters read equal positive values

(B) One wattmeter reads zero and the other reads the total active power

(C) Both wattmeters read zero

(D) One reads positive and the other reads negative

83. A Cathode Ray Oscilloscope (CRO) can be directly used to measure :

(A) Voltage only

(B) Current only

(C) Voltage, frequency, time period, and waveform shape

(D) Power only

84. In a single-phase induction-type energy meter, creep is prevented by :

(A) Using a stronger braking (eddy current) magnet

(B) Reducing the air gap in the magnetic circuit

(C) Increasing the number of turns in the voltage coil

(D) Drilling a small hole or attaching a small piece of iron to the aluminium disc

85. A digital Time of Day (TOD) energy meter, compared to a conventional electromechanical meter, offers the additional advantage of :

(A) Higher mechanical robustness

(B) Measuring energy at different tariff rates based on the time of use

(C) Better accuracy at low power factors

(D) Immune to voltage surges

86. A system is said to be linear if it satisfies :

(A) Time invariance only

(B) Causality and memory properties

(C) The superposition principle (additivity and homogeneity)

(D) Stability criterion

87. The Nyquist sampling theorem states that a band-limited continuous-time signal with highest frequency component fmax must be sampled at a rate fs such that :

(A) $fs = fmax$ (B) $fs \geq 2fmax$

(C) $fs \geq 3fmax$ (D) $fs \leq fmax/2$

88. The unit impulse function $\delta(t)$ is characterized by the property that :

(A) $\delta(t) = 0$ for t $\neq 0$, $\int_{-\infty}^{\infty} \delta(t)\,dt = 1$ (B) $\delta(t) = 1$ for all values of t

(C) $\delta(t) = 0$ for all $t$ including t = 0 (D) $\delta(t) = u(t) - u(t-1)$

89. A Zero-Order Hold (ZOH) circuit is used in digital control systems to :

(A) Sample a continuous-time signal at regular intervals

(B) Reconstruct a staircase (piecewise constant) approximation of a continuous signal from its samples

(C) Filter high-frequency noise from analog signals

(D) Convert digital signals to parallel form

90. A Linear Time-Invariant (LTI) system is causal if and only if :

(A) Its impulse response h(t) = 0 for all $t < 0$

(B) Its impulse response extends to $t \to -\infty$

(C) The output can depend on future values of the input

(D) The system contains memory elements only

91. The Laplace transform of the unit ramp signal $r(t) = t \cdot u(t)$ is :

(A) $1/s$ (B) $1/(s + 1)$

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

92. The z-transform of the discrete-time sequence $x[n] = (0 \cdot 5)^n u[n]$ is :

(A) $z/(z - 0.5)$ (B) $1/(1 - 0.5z)$

(C) $0.5z/(z - 0.5)$ (D) $z/(z + 0.5)$

93. Aliasing in a sampled-data system occurs when :

(A) The sampling rate is exactly equal to twice the maximum signal frequency

(B) The sampling rate is less than twice the maximum signal frequency

(C) The signal is perfectly band-limited

(D) The system has an infinite memory

94. An LVDT (Linear Variable Differential Transformer) is a transducer used to measure :

(A) Temperature
(B) Pressure
(C) Angular velocity
(D) Linear displacement

95. A Hall-effect transducer is primarily used to measure :

(A) Temperature
(B) Linear displacement
(C) Magnetic flux density
(D) Acoustic pressure

96. A primary cell differs from a secondary cell (storage battery) in that :

(A) Primary cells can be recharged; secondary cells cannot
(B) Primary cells irreversibly convert chemical energy to electrical energy and cannot be recharged: secondary cells are rechargeable
(C) Primary cells produce AC while secondary cells produce DC
(D) Primary cells have higher terminal voltage than secondary cells

97. According to the Indian Electricity Rules, the earth electrode resistance for electrical installations (low voltage systems) should generally not exceed :

(A) 5 Ω
(B) 1 Ω
(C) 10 Ω
(D) 25 Ω

98. In a looping-in system of domestic wiring, the live wire is looped from one switch box to another, and it is always recommended that the switch is connected in the :

(A) Neutral wire
(B) Earth wire
(C) Live (phase) wire
(D) Both live and neutral wires

99. Lambert's Cosine Law of illumination states that the illuminance (E) on a surface is :

(A) Proportional to the square of the distance from the light source
(B) Proportional to the cosine of the angle of incidence
(C) Independent of the angle of incidence
(D) Proportional to the solid angle subtended

100. The luminous efficacy of a light source is defined as :

(A) Luminous flux per unit illuminated area (lux)
(B) Luminous intensity per unit solid angle (candela)
(C) Total luminous flux (in lumens) produced per watt of electrical power consumed
(D) Total radiant flux emitted in all directions