Name of Post:	Assistant Manager (Electrical & HR) in Assam Power Generation Corporation Limited (APGCL)
Advt. No.	11/2023 dated 25.04.2023
Date of Exam.	15.10.2023

AM/APGCL/I/23

ASKED TO DO SO

Test Booklet No. :

Series

A

00813

TEST BOOKLET

Paper—I

(ELECTRICAL ENGINEERING)

Time Allowed : 2 Hours **Full Marks : 100**

Read the following instructions carefully before you begin to answer the questions :

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
3. All questions carry equal marks.

   The Answer-Sheet should be submitted to the Invigilator.

   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.

   Example :

   Suppose the following question is asked :

   The capital of Bangladesh is
   (A) Chennai
   (B) London
   (C) Dhaka
   (D) Dhubri

   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   Ⓐ Ⓑ ● Ⓓ

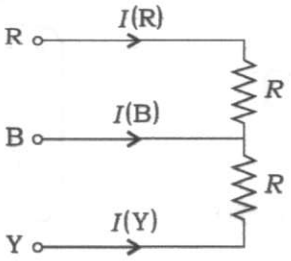
   The example shown above is the only correct method of answering.
4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
5. Please ensure that the Test Booklet has the required number of pages (20) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.
10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

SEAL

[No. of Questions : 100]

1. For the figure shown below, the ratio of the currents in all the phases R, Y, B is given by



(A) $1 : 1 : \sqrt{3}$

(B) $1 : 1 : 2$

(C) $1 : 1 : 0$

(D) $1 : 1 : \sqrt{\frac{3}{2}}$

2. An ideal voltage source will charge an ideal capacitor

(A) in infinite time

(B) exponentially

(C) immediately

(D) instantaneously

3. A two-phase load draws the following phase currents :

$$i_1(t) = I_m \sin(\omega t - \phi_1)$$

$$i_2(t) = I_m \cos(\omega t - \phi_2)$$

These currents are balanced if ϕ_1 is equal to

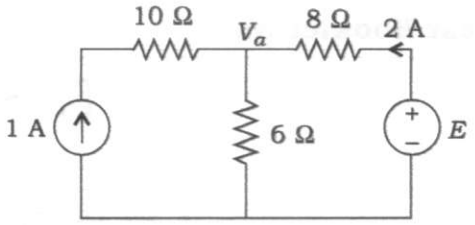
(A) $-\phi_2$

(B) ϕ_2

(C) $\left\{\left(\frac{\pi}{2}\right) - \phi_2\right\}$

(D) $\left\{\left(\frac{\pi}{2}\right) + \phi_2\right\}$

4. In the figure given below, the value of the source voltage is



(A) 12 V

(B) 24 V

(C) 30 V

(D) 44 V

5. The r.m.s. value of the current in a wire which carries a DC current of 10 A and a sinusoidal alternating current of peak value 20 A is

(A) 10 A

(B) 14·14 A

(C) 15 A

(D) 17·32 A

6. The r.m.s. value of the half-wave rectified symmetrical square wave current of 2 A is

(A) $\sqrt{2}$ A

(B) 1 A

(C) $\frac{1}{\sqrt{2}}$ A

(D) $\sqrt{3}$ A

7. The average power delivered to an impedance $(4 - j3)\ \Omega$ by a current $5\cos(100\pi t + 100)$ A is

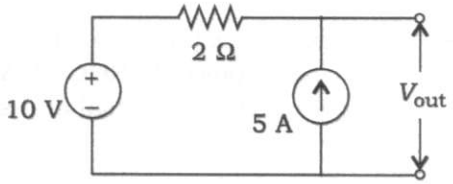
(A) 44·2 W

(B) 50 W

(C) 62·5 W

(D) 125 W

8. In the circuit shown below, the voltage and current sources are ideal. The voltage (V_{out}) across the current source, in volts, is



(A) 0

(B) 5

(C) 10

(D) 20

9. The graph of an electric network has N nodes and B branches. The number of links L, with respect to the choice of a tree, is given by

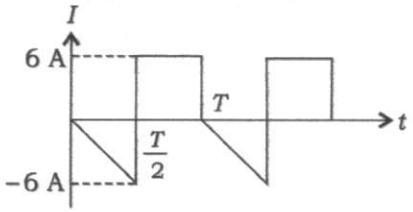
(A) $N - 2B - 1$

(B) $N - B + 1$

(C) $B + N$

(D) $B - N + 1$

10. The r.m.s. value of the periodic waveform given in the figure below is



(A) $2\sqrt{6}$ A

(B) $6\sqrt{2}$ A

(C) $\sqrt{\frac{4}{3}}$ A

(D) 1·5 A

11. A linear time invariant system with an impulse response $h(t)$ produces output $y(t)$, when input $x(t)$ is applied. When the input $x(t - \tau)$ is applied to a system with impulse response $h(t - \tau)$, the output will be

(A) $y(\tau)$

(B) $y(2(t - \tau))$

(C) $y(t - \tau)$

(D) $y(t - 2\tau)$

12. An LTI system is described by the equation

$$y[n] - 2ay[n-1] + a^2 y[n-2] = x[n] - ax[n-1]$$

If the LTI system is causal and unstable, then

(A) $|a| < 1$

(B) $|a| > 0{\cdot}5$

(C) $|a| \geq 1$

(D) Not possible

13. If $h[n] = \{\underset{\uparrow}{1}, 1\}$ is impulse response of an LTI system, then the system's magnitude response varies with ω as

(A) cosine

(B) sine

(C) exponential

(D) ramp

14. Given $x(t) = Ae^{t}u(t)$, then $x(t)$ is

(A) both energy and power signal

(B) energy signal only

(C) power signal only

(D) neither energy signal nor power signal

15. For transfer function of a linear time invariant system is given as

$$G(s) = \frac{1}{s^2 + 3s + 2}$$

The steady state value of the output of the system for a unit impulse input applied at time instant $t = 1$ will be

(A) 0

(B) 0·5

(C) 1

(D) 2

16. In standard TTL gates, the totem pole output stage is primarily used to

(A) decrease the output switching delay

(B) increase the noise margin

(C) facilitate a wired OR logic connection

(D) increase the output impedance of the circuit

17. A signal $x[n]$ of ZT

$$X(z) = 1 + z^{-1} + z^{-2}$$

is passed through a system of impulse response $h[n] = \delta[n-4]$. Then $y[n]$ at $n = 3$ is

(A) 2

(B) 0

(C) 1

(D) −1

18. Let $Z\{x[n]\} = X(z)$, then which of the following is possible ROC of $X(z)$, if the system is anti-causal and stable?

(A) $2 < |z| < 3$

(B) $|z| < 3$

(C) $|z| > 1$

(D) $|z| < 0 \cdot 5$

19. Which of the following is a Fourier series expansion of periodic signal?

(A) $\cos \pi t + \cos \pi t$

(B) $\cos(\sqrt{3}t) + \cos(3\sqrt{3}t)$

(C) $\sin t + \cos(5t)$

(D) $\sin t + \cos(\sqrt{3}t)$

20. The unit step response of an LTI system has a Laplace transform of $\frac{1}{s^2+4s}$. Then the impulse response of the system is

(A) $\frac{1}{4}(e^{-4t}-1)u(t)$

(B) $e^{-4t}u(t)$

(C) $-e^{-4t}u(t)$

(D) $\frac{1}{4}(1-e^{-4t})u(t)$

21. The parts of the armature electric circuit which take active part in electromotive force generation are

(A) the coil sides inside the slots

(B) the overhangs

(C) both the coil sides inside the slots and the overhangs

(D) the commutator segments

22. For DC shunt motors, the field excitation is kept at maximum value during starting to

(A) increase acceleration time

(B) decrease starting time

(C) reduce armature heating

(D) prevent voltage dip in the supply main

23. Plugging of DC motors is normally excited by

(A) reversing the field polarity

(B) reversing the armature polarity

(C) reversing both the field and armature polarities

(D) connecting a resistance across the armature

24. A 240 V DC shunt motor with an armature resistance of 0·5 Ω has a full-load current of 40 A. Find the ratio of the stalling torque to the full-load torque when a resistance of 1 Ω is connected in series with the armature.

(A) 4

(B) 12

(C) 6

(D) None of the above

25. A 4-pole dynamo with wave-wound armature has 51 slots containing 20 conductors in each slot. The induced e.m.f. is 357 volts and the speed is 8500 r.p.m. The flux per pole will be

(A) 3·5 mWb

(B) 1·2 mWb

(C) 14 mWb

(D) 21 mWb

26. When load on a transformer is increased, eddy current loss

(A) is increased

(B) remains unchanged

(C) is decreased

(D) None of the above

27. The no-load power factor of a transformer is small because

(A) iron loss component of I_0 is large

(B) magnetizing component of I_0 is large

(C) magnetizing component of I_0 is small

(D) None of the above

28. In single-phase induction motor, the starting torque and the efficiency as compared to 3-ϕ IM are respectively

(A) high, high

(B) low, low

(C) zero, low

(D) zero, equal

29. The direction of rotor of DC series motor can be reversed

(A) by interchanging the supply terminals

(B) by interchanging the field terminals

(C) Either (A) or (B)

(D) None of the above

30. The resultant flux density in the air gap of a synchronous generator is the lowest during

(A) open circuit

(B) solid short circuit

(C) full load

(D) half load

31. A DC shunt generator driven at normal speed in the normal direction fails to build up armature voltage because

(A) the field current is not sufficiently high

(B) the armature resistance is very high

(C) DC supply has odd harmonics

(D) there is no residual magnetism

32. The synchronous speed for the seventh space harmonic m.m.f. wave of a 3-phase, 8-pole, 50 Hz induction machine is

(A) 107·14 r.p.m. in forward direction

(B) 107·14 r.p.m. in reverse direction

(C) 5250 r.p.m. in forward direction

(D) 5250 r.p.m. in reverse direction

33. It is desirable to eliminate 5th harmonic voltage from the phase voltage of an alternator. The coils should be short-pitched by an electrical angle of

(A) 30°

(B) 36°

(C) 72°

(D) 18°

34. If a 400 V, 50 Hz, star-connected, 3-phase, squirrel-cage induction motor is operated from a 400 V, 75 Hz supply, the torque that the motor can now provide while drawing rated current from the supply

(A) decreases

(B) increases

(C) remains same

(D) increases or decreases depending on rotor resistance

35. A synchronous generator is feeding a zero power factor (lagging) load at rated current. The armature reaction is

(A) magnetizing

(B) demagnetizing

(C) cross-magnetizing

(D) ineffective

36. The parameters of transposed over-head transmission line are given as : self-reactance $X_s = 0{\cdot}4\ \Omega/\text{km}$ and mutual reactance $X_m = 0{\cdot}1\ \Omega/\text{km}$. The positive sequence reactance X_1 and zero sequence reactance X_0 respectively, in Ω/km, are

(A) 0·3, 0·2

(B) 0·5, 0·2

(C) 0·5, 0·6

(D) 0·3, 0·6

37. An extra high-voltage transmission line of length 300 km can be approximated by a lossless line having propagation constant $\beta = 0{\cdot}00127$ rad per km. Then the percentage ratio of line length to wavelength will be given by

(A) 24·24%

(B) 12·12%

(C) 19·05%

(D) 6·06%

38. At an industrial sub-station with a 4 MW load, a capacitor of 2 MVAR is installed to maintain the load power factor at 0·97 lagging. If the capacitor goes out of service, the load power factor becomes

(A) 0·85 lagging

(B) 1·00 lagging

(C) 0·90 lagging

(D) 0·80 lagging

39. In a 400 kV network, 360 kV is recorded at a 400 kV bus. The reactive power absorbed by a shunt reactor rated for 50 MVAR, 400 kV connected at the bus is

(A) 61·73 MVAR

(B) 55·56 MVAR

(C) 45·5 MVAR

(D) 40 MVAR

40. The transient stability of the power system can be effectively improved by

(A) improving generator excitation

(B) phase-shifting transformer

(C) single-pole switching circuit breakers

(D) increasing the turbine valve opening

41. A cable has the following characteristics :

$L = 0{\cdot}201\ \mu H/m$

$C = 196{\cdot}2\ pF/m$

The velocity of wave propagation through the cable is

(A) 32 m/s

(B) 159·24 m/ms

(C) 0·0312 m/s

(D) 159·24 m/μs

42. An 800 kV transmission line has a maximum power transfer capacity of P. If it is operated at 400 kV with the series reactance unchanged, then the new maximum power transfer capacity is approximately

(A) P

(B) $2P$

(C) $\frac{P}{2}$

(D) $\frac{P}{4}$

43. The incremental cost characteristics of two generators delivering 200 MW are as follows :

$$\frac{dF_1}{dP_1} = 20 + 0 \cdot 1P_1$$

$$\frac{dF_2}{dP_2} = 16 + 0 \cdot 2P_2$$

For economic operation, the generations P_1 and P_2 should be

(A) $P_1 = P_2 = 100$ MW

(B) $P_1 = 80$ MW, $P_2 = 120$ MW

(C) $P_1 = 200$ MW, $P_2 = 0$ MW

(D) $P_1 = 120$ MW, $P_2 = 80$ MW

44. A three-phase, 33 kV oil circuit breaker is rated at 1200 A, 2000 MVA, 3 s. The symmetrical breaking current is

(A) 1200 A

(B) 3600 A

(C) 35 kA

(D) 104·8 kA

45. The plug setting of a negative sequence relay is 0·2 A. The current transformer ratio is 5 : 1. The minimum value of line-to-line fault current for the operation of the relay is

(A) 1 A

(B) $\frac{1}{1 \cdot 732}$ A

(C) 1·732 A

(D) $\frac{0 \cdot 2}{1 \cdot 732}$ A

46. A power system has 100 buses including 10 generator buses. For the load flow analysis using Newton-Raphson method in polar coordinates, the size of the Jacobian is

(A) 189 × 189

(B) 100 × 100

(C) 90 × 90

(D) 180 × 180

47. For harnessing low variable water heads, the suitable hydraulic turbine with high percentage of reaction and runner adjustable vanes is

(A) Kaplan

(B) Francis

(C) Pelton

(D) Impeller

48. Consider two buses connected by an impedance of $(0 + j5)\ \Omega$. The bus 1 voltage is $100 \angle 30°$ V and bus 2 voltage is $100 \angle 0°$ V. The real and reactive power supplied by bus 1, respectively are

(A) 1000 W, 268 VAR

(B) −1000 W, −134 VAR

(C) 276·9 W, −56·7 VAR

(D) −276·9 W, 56·7 VAR

49. Two protective zones in the electrical transmission system are decided by

(A) location of PT

(B) location of CT

(C) relay's size

(D) relay's sensitivity

50. Whenever the conductors are dead-ended or there is a change in the direction of the transmission line, the insulators used are of

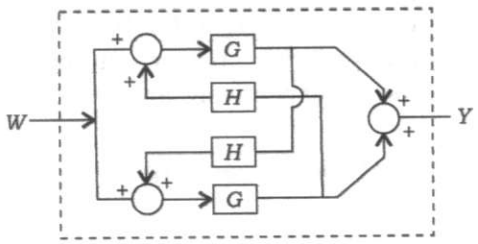
(A) pin type

(B) suspension type

(C) strain type

(D) shackle type

51. The overall transfer function of the system shown in the figure below is



(A) $\frac{G}{1-GH}$

(B) $\frac{2G}{1-GH}$

(C) $\frac{GH}{1-GH}$

(D) $\frac{GH}{1-H}$

52. A unity feedback system has the open-loop transfer function

$$G(s)=\frac{25}{s(s+6)}$$

The peak overshoot in step input response of the system is approximately equal to

(A) 5%

(B) 10%

(C) 15%

(D) 20%

53. The loop gain GH of a closed-loop system is given by the expression

$$\frac{K}{s(s+2)(s+4)}$$

The value of K for which the system just becomes unstable is

(A) 6

(B) 8

(C) 48

(D) 96

54. The transfer function of a system is given as

$$\frac{100}{s^2+20s+100}$$

The system is

(A) an overdamped system

(B) an underdamped system

(C) a critically damped system

(D) an unstable system

55. As per Blondel's theorem, the minimum number of wattmeters required to measure 3-phase 3-wire balanced or unbalanced power is

(A) 1

(B) 2

(C) 3

(D) 4

56. The range of K for which all the roots of the equation $s^3 + 3s^2 + 2s + K = 0$ are in the left half of the complex s-plane is

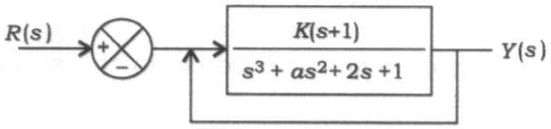
(A) $0 < K < 6$

(B) $0 < K < 16$

(C) $6 < K < 36$

(D) $6 < K < 16$

57. The feedback system shown below oscillates at 2 rad/s, when



(A) $K = 2$ and $a = 0{\cdot}75$

(B) $K = 3$ and $a = 0{\cdot}75$

(C) $K = 4$ and $a = 0{\cdot}5$

(D) $K = 2$ and $a = 0{\cdot}5$

58. The root locus of the feedback control system having the characteristic equation

$$s^2 + 6Ks + 2s + 5 = 0$$

where $K > 0$, enters into the real axis at

(A) $s = -1$

(B) $s = -\sqrt{5}$

(C) $s = -5$

(D) $s = \sqrt{5}$

59. The closed-loop transfer function of a control system is given by

$$\frac{C(s)}{R(s)} = \frac{1}{1+s}$$

For the input $r(t) = \sin t$, the steady-state value of $c(t)$ is equal to

(A) $\frac{1}{\sqrt{2}}\cos t$

(B) 1

(C) $\frac{1}{\sqrt{2}}\sin t$

(D) $\frac{1}{\sqrt{2}}\sin\left(t - \frac{\pi}{4}\right)$

60. If $G(s) = \frac{0{\cdot}5s + 1}{0{\cdot}05s + 1}$, then the maximum phase lead of the compensator is

(A) 52 deg at 4 rad/s

(B) 52 deg at 10 rad/s

(C) 55 deg at 12 rad/s

(D) None of the above

61. The transfer functions of two compensators are given below :

$$C_1 = \frac{10(s+1)}{s+10}, \quad C_2 = \frac{s+10}{10(s+1)}$$

Which one of the following statements is correct?

(A) C_1 is a lead compensator and C_2 is a lag compensator.

(B) C_1 is a lag compensator and C_2 is a lead compensator.

(C) Both C_1 and C_2 are lead compensators.

(D) Both C_1 and C_2 are lag compensators.

62. Consider a linear time invariant system $\dot{x} = Ax$, with initial condition $x(0)$ at $t = 0$. Suppose α and β are eigenvectors of (2×2) matrix A corresponding to distinct eigenvalues λ_1 and λ_2 respectively. Then the response $x(t)$ of the system due to initial condition $x(0) = \alpha$ is

(A) $\alpha e^{\lambda_1 t}$

(B) $\beta e^{\lambda_2 t}$

(C) $\alpha e^{\lambda_2 t}$

(D) $\alpha e^{\lambda_1 t} + \beta e^{\lambda_2 t}$

63. The eigenvalues of the matrix $\begin{bmatrix} a & 1 \\ a & 1 \end{bmatrix}$ are

(A) $(a+1)$, 0

(B) a, 0

(C) $(a-1)$, 0

(D) 0, 0

64. Resistances R_1 and R_2 have respectively nominal values of $10\,\Omega$ and $5\,\Omega$, and tolerances of $\pm 5\%$ and $\pm 10\%$. The range of value for the parallel combination of R_1 and R_2 is

(A) $3{\cdot}077\,\Omega$ to $3{\cdot}636\,\Omega$

(B) $2{\cdot}805\,\Omega$ to $3{\cdot}371\,\Omega$

(C) $3{\cdot}237\,\Omega$ to $3{\cdot}678\,\Omega$

(D) $3{\cdot}192\,\Omega$ to $3{\cdot}435\,\Omega$

65. A 0–10 mA PMMC ammeter reads 4 mA in a circuit. Its bottom control spring snaps suddenly. The meter will now read nearly

(A) 10 mA

(B) 8 mA

(C) zero

(D) 2 mA

66. A metal strain gauge has factor of two and its normal resistance is 120 ohms. It undergoes a strain of 10^{-5}. The value of change of resistance in response to the strain is

(A) 240 ohms

(B) 2×10^{-5} ohm

(C) $2{\cdot}4 \times 10^{-3}$ ohm

(D) $1{\cdot}2 \times 10^{-3}$ ohm

67. A moving coil of a meter has 100 turns, and length and depth of 10 mm and 20 mm respectively. It is positioned in a uniform radial flux density of 200 mT. The coil carries a current of 50 mA. The torque on the coil is

(A) 200 μN-m

(B) 100 μN-m

(C) 2 μN-m

(D) 1 μN-m

68. A DC potentiometer is designed to measure up to 2 V with a slide wire of 800 mm. A standard cell of e.m.f. 1·18 V obtains balance at 600 mm. A test cell is seen to obtain balance at 680 mm. The e.m.f. of the test cell is

(A) 1·00 V

(B) 1·34 V

(C) 1·50 V

(D) 1·70 V

69. Power consumed by a balanced 3-phase, 3-wire load is measured by two-wattmeter method. The first wattmeter reads twice that of the second. Then the load impedance angle in radian is

(A) $\frac{\pi}{12}$

(B) $\frac{\pi}{8}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{3}$

70. A DC ammeter has a resistance of 0·1 ohm and its current range is 0–100 A. If the range is to be extended to 0–500 A, then the meter requires which of the following shunt resistances?

(A) 0·010 Ω

(B) 0·011 Ω

(C) 0·025 Ω

(D) 1·0 Ω

71. The pressure coil of a dynamometer type wattmeter is

(A) highly inductive

(B) highly resistive

(C) purely resistive

(D) purely inductive

72. In an oscilloscope screen, linear sweep is applied at

(A) the horizontal axis

(B) the vertical axis

(C) the origin

(D) both the horizontal and vertical axes

73. The electrical resistance is analogous to

(A) spring

(B) viscous damper

(C) fluid capacity

(D) inertia

74. A low-pass filter with a cut-off frequency of 30 Hz is cascaded with a high-pass filter with a cut-off frequency of 20 Hz. The resultant system of filters will function as

(A) an all-pass filter

(B) an all-stop filter

(C) a band-stop (band-reject) filter

(D) a band-pass filter

75. An op-amp has an open-loop gain of 10^5 and an open-loop upper cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed-loop gain of 100, then the new upper cut-off frequency is

(A) 10 Hz

(B) 100 Hz

(C) 10 kHz

(D) 100 kHz

76. A charger can charge a laptop's battery with 100 W at 20 V. A switching frequency of 200 kHz is used by the power components in the converter inside the charger. Which electrical appliance is most appropriate for this use?

(A) IGBT

(B) MOSFET

(C) SCR

(D) BJT

77. The simplified form of the Boolean expression $Y = (\overline{A}BC + D)(\overline{A}D + \overline{B}\,\overline{C})$ can be written as

(A) $Y = \overline{A}D + \overline{BCD}$

(B) $Y = AD + B\overline{C}D$

(C) $Y = (\overline{A} + D)(\overline{B}C + \overline{D})$

(D) $Y = A\overline{D} + BC\overline{D}$

78. The logic function $f = \overline{(x \cdot \overline{y}) + (\overline{x} \cdot y)}$ is the same as

(A) $f = (x + y) + (\overline{x} \cdot \overline{y})$

(B) $f = \overline{(\overline{x} + \overline{y})(x + y)}$

(C) $f = (\overline{x \cdot y})(\overline{x} \cdot \overline{y})$

(D) None of the above

79. In the sum of product function

$$f(X, Y, Z) = \Sigma(2, 3, 4, 5)$$

the prime implicants are

(A) $\overline{X}Y + X\overline{Y}$

(B) $\overline{X}Y + X\overline{YZ} + X\overline{Y}Z$

(C) $\overline{X}Y\overline{Z} + \overline{X}YZ + X\overline{Y}$

(D) $\overline{X}Y\overline{Z} + \overline{X}YZ + X\overline{YZ} + X\overline{Y}Z$

80. The output Y of a 2-bit comparator is logic 1, whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1, is

(A) 4

(B) 6

(C) 8

(D) 10

81. An 8-bit unipolar successive approximation register type ADC is used to convert 3·5 V to digital equivalent output. The reference voltage is +5 V. The output of the ADC at the end of the 3rd clock pulse after the start conversion is

(A) 1010 0000

(B) 1000 0000

(C) 0000 0001

(D) 0000 0011

82. The open collector outputs of two-input NAND gates are connected to a common pull-up resistor. If the input to the gates are P, Q and R, S respectively, the output is equal to

(A) $\overline{PQ} \cdot \overline{RS}$

(B) $\overline{PQ} + \overline{RS}$

(C) $PQ + RS$

(D) $PQRS$

83. The 8085 assembly language instruction that stores the contents of H and L registers into the memory locations 2050H and 2051H, respectively, is

(A) SPHL 2050H

(B) SPHL 2051H

(C) SHLD 2050H

(D) STAX 2050H

84. In an 8085 microprocessor, after the execution of XRA A instruction

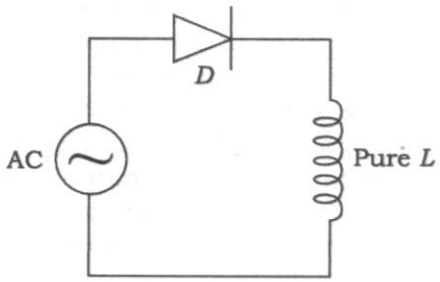
(A) the carry flag is set

(B) the accumulator contains FFH

(C) the zero flag is set

(D) the accumulator contents are shifted by one bit

85. In the circuit given below, the diode connects the AC source to a pure inductance L :



The diode conducts for

(A) 90°

(B) 180°

(C) 270°

(D) 360°

86. A single-phase fully controlled thyristor bridge AC-DC converter is operating at a firing angle of 25° and an overlap angle of 10° with constant DC output current of 20 A. The fundamental power factor (displacement factor) at input AC mains is

(A) 0·78

(B) 0·827

(C) 0·866

(D) 0·9

87. Circuit turn-off time of an SCR is defined as the time

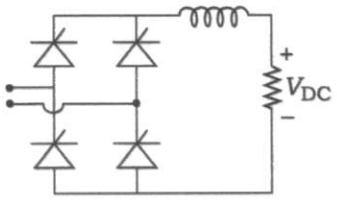
(A) taken by the SCR to turn off

(B) required for the SCR current to become zero

(C) for which the SCR is reverse biased to reduce its current below the holding current

(D) for which the SCR is reverse biased by the commutation circuit

88. The fully controlled thyristor converter in the figure below is fed from a single-phase source. When the firing angle is 0°, the DC output voltage of the converter is 300 V. What will be the output voltage for a firing angle of 60°, assuming continuous conduction?



(A) 150 V (B) 210 V

(C) 300 V (D) 100π V

89. A single-phase thyristor bridge rectifier is fed from a 230 V, 50 Hz, single-phase AC mains. If it is delivering a constant DC current of 10 A, at firing angle of 30°, then the value of the power factor at AC mains is

(A) 0·87

(B) 0·9

(C) 0·78

(D) 0·45

90. A step-down chopper is operated in the continuous conduction mode in steady state with a constant duty ratio D. If V_o is the magnitude of the DC output voltage and if V_s is the magnitude of the DC input voltage, the ratio of $\frac{V_o}{V_s}$ is given by

(A) D

(B) $1 - D$

(C) $\frac{1}{1-D}$

(D) $\frac{D}{1-D}$

91. A single-phase full-bridge voltage source inverter (VSI) is fed from a 300 V battery. A pulse of 120° duration is used to trigger the appropriate devices in each half-cycle. The r.m.s. value of the fundamental component of the output voltage, in volts, is

(A) 234

(B) 245

(C) 300

(D) 331

92. The output voltage waveform of a three-phase square-wave inverter contains

(A) only even harmonics

(B) both odd and even harmonics

(C) only odd harmonics

(D) only triple harmonics

93. A parallel-plate capacitor has an electrode area of 100 mm^2, with spacing of 0·1 mm between the electrodes. The dielectric between the plates is air with a permittivity of $8{\cdot}85 \times 10^{-12}$ F/m. The voltage on the capacitor is 100 V. The stored energy in the capacitor is

(A) 8·85 pJ

(B) 440 pJ

(C) 22·1 nJ

(D) 44·3 nJ

94. An electric motor, developing a starting torque of 15 N-m, starts with a load torque of 7 N-m of its shaft. If the acceleration at start is 2 rad/sec^2, the moment of inertia of the system must be (neglecting viscous and Coulomb friction)

(A) 0·25 $kg\text{-}m^2$

(B) 0·25 $N\text{-}m^2$

(C) 4 $kg\text{-}m^2$

(D) 4 $N\text{-}m^2$

95. A capacitor is made with a polymeric dielectric having an ε_r of 2·26 and a dielectric breakdown strength of 50 kV/cm. The permittivity of free space is 8·85 pF/m. If the rectangular plates of the capacitor have a width of 20 cm and a length of 40 cm, then the maximum electric charge in the capacitor is

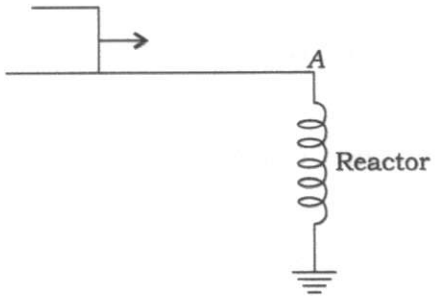
(A) 2 μC

(B) 4 μC

(C) 8 μC

(D) 10 μC

96. Consider a step voltage wave of magnitude 1 pu travelling along a lossless transmission line that terminates in a reactor. The voltage magnitude across the reactor at the instant the travelling wave reaches the reactor is



(A) –1 pu

(B) 1 pu

(C) 2 pu

(D) 3 pu

97. The flux density at a point space is given by $B = 4xa_x + 2kya_y + 8a_z$ Wb/m^2. The value of constant k must be equal to

(A) –2

(B) –0·5

(C) +0·5

(D) +2

98. The conductors of 10 km long, single-phase, two-wire line are separated by a distance of 1·5 m. The diameter of each conductor is 1 cm. If the conductors are of copper, the inductance of the circuit is

(A) 50·0 mH

(B) 45·3 mH

(C) 23·8 mH

(D) 12·4 mH

99. A three-phase semiconverter feeds the armature of separately excited DC motor, supplying a non-zero torque. For steady-state operation, the motor armature current is found to drop to zero at certain instances of time. At such instances, the voltage assumes a value that is

(A) zero

(B) arbitrary

(C) equal to the instantaneous value of the AC phase voltage

(D) equal to the instantaneous value of the motor back e.m.f.

100. The inductance of a long solenoid of length 1000 mm wound uniformly with 3000 turns on a cylindrical paper tube of 60 mm diameter is

(A) 3·2 μH

(B) 3·2 mH

(C) 32·0 mH

(D) 3·2 H

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