Name of Post:	Assistant Manager (Electrical & Civil) in Assam Power Distribution Company Limited (APDCL)
Advt. No.	06/2023 dated 28.03.2023
Date of Screening Test	10.09.2023

10/09/2023

AM/APDCL/I/23

ASKED TO DO SO

Series

B

TEST BOOKLET

01682

Paper—I

(ELECTRICAL ENGINEERING)

Time Allowed : 2 Hours **Full Marks : 150**

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 (23) 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.

/127-B **[No. of Questions : 100]**

SEAL

1. In d.c. potentiometer measurements, a second reading is often taken after reversing the polarities of the d.c. supply and the unknown voltage source, and the average of the 2 readings is taken. This is done to eliminate the effects of

(A) ripples in the d.c. supply

(B) stray magnetic fields

(C) stray thermal e.m.f.s

(D) erroneous standardization

2. In calibration of dynamometer type wattmeter by potentiometer, phantom loading is used because

(A) the arrangement gives accurate results

(B) the power consumed during calibration period is minimum

(C) the method gives quick results

(D) the onsite calibration is possible

3. An energy meter having a meter constant of 1200 revolutions/kWh is found to make 5 revolutions in 75 seconds. The load power is

(A) 200 W

(B) 100 W

(C) 500 W

(D) 1000 W

4. Which bridge is generally used to measure frequency among the following?

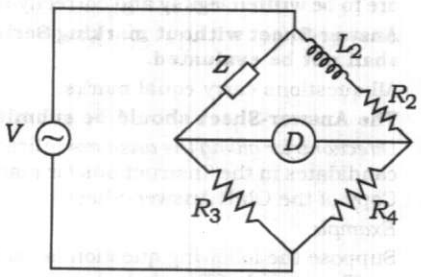
(A) Anderson bridge

(B) De Sauty's bridge

(C) Wien bridge

(D) Campbell bridge

5. In the balanced bridge shown in the figure below, Z should be



(A) self-inductance having resistance

(B) a capacitance

(C) non-inductive resistance

(D) an inductance and capacitance in parallel

6. A cathode-ray oscilloscope (CRO) screen has 10 divisions on the horizontal scale. If a voltage signal of $5\sin(100\pi t + 45°)$ is examined with a line base setting of 5 msec division, then the number of cycles of signal displayed on the screen will be

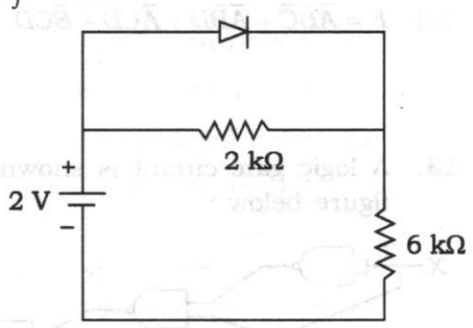
(A) 0·5

(B) 2·5

(C) 5

(D) 10

7. Assume that the diode in the following figure has $V_{on} = 0{\cdot}7$ V and $R_f = 0\ \Omega$:



The magnitude of current in the 6 kΩ resistor is equal to

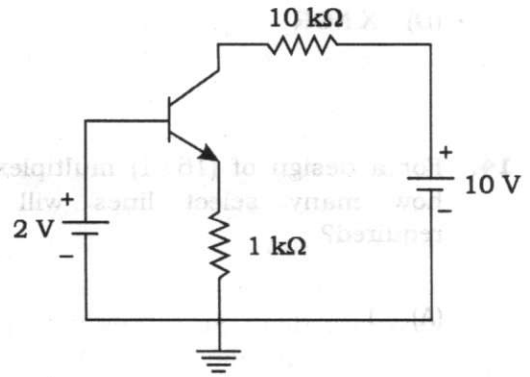
(A) 0·25 mA

(B) 0·35 mA

(C) 0·22 mA

(D) 0·57 mA

8. For the BJT circuit shown in the following figure, assume that β is very large and $V_{BE} = 0{\cdot}7$ V. The mode of operation of the BJT is



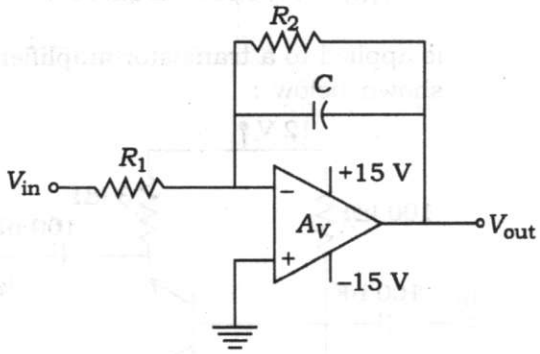
(A) cut-off

(B) normal active

(C) saturation

(D) reverse active

9. The circuit shown below is an example of



(A) low-pass filter

(B) band-pass filter

(C) high-pass filter

(D) notch filter

10. Of the 4 characteristics given below, which are the major requirements for an instrumentation amplifier?

I. High common-mode rejection ratio

II. High input impedance

III. High linearity

IV. High output impedance

Choose the correct option using the code given below.

(A) I, II, III

(B) I, III, IV

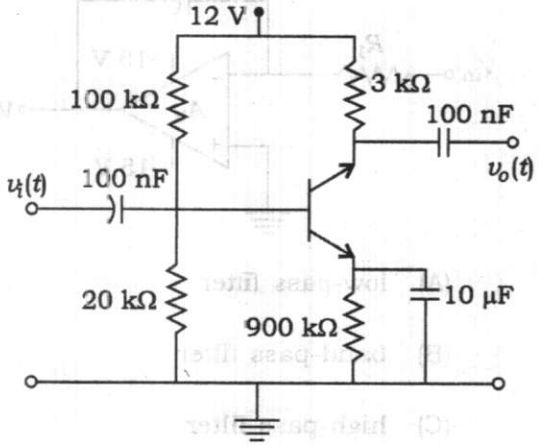
(C) I, III

(D) II, III, IV

11. A small signal source

$$v_i(t) = A\cos 20t + B\sin 10^6 t$$

is applied to a transistor amplifier as shown below :



The transistor has $\beta = 150$ and $h_{ie} = 3\ k\Omega$. Which expression best approximates $v_o(t)$?

(A) $v_o(t) = -1500(A\cos 20t + B\sin 10^6 t)$

(B) $v_o(t) = -150(A\cos 20t + B\sin 10^6 t)$

(C) $v_o(t) = -1500B\sin 10^6 t$

(D) $v_o(t) = -150B\sin 10^6 t$

12. The sum of prcduct form of a Boolean function is $F = \Sigma(0, 1, 3, 7, 11)$, where inputs are arranged as $ABCD$, where A is MSB (i.e., most significant bit) and D is LSB (i.e., least significant bit). The equivalent minimized product-of-sum (PoS) expression of the function F is

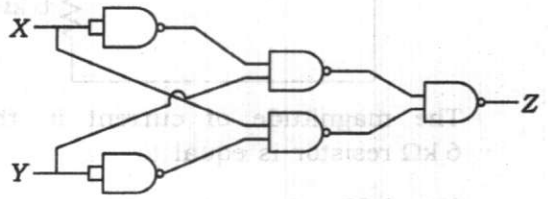
(A) $F = (\bar{B} + C)(\bar{A} + C)(A + B)(C + \bar{D})$

(B) $F = (\bar{B} + C)(\bar{A} + C)(\bar{A} + \bar{B})(\bar{C} + D)$

(C) $F = (B + \bar{C})(A + \bar{C})(A + B)(C + \bar{D})$

(D) $F = \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}D + \bar{A}CD + \bar{B}CD$

13. A logic gate circuit is shown in the figure below :



The logic function realized by the above logic circuit is

(A) full-adder

(B) half-adder

(C) X OR

(D) X NOR

14. For a design of (16 : 1) multiplexer, how many select lines will be required?

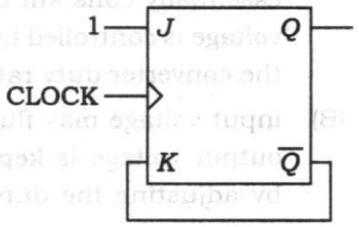
(A) 1

(B) 3

(C) 4

(D) 2

15. In the figure shown below, the initial state of Q is 0. The output is observed after the application of each clock pulse :



The output sequence at Q is

(A) 0000...

(B) 1010...

(C) 1111...

(D) 1000...

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

(A) 10100000

(B) 11000000

(C) 11100000

(D) 10000011

17. A thyristor is considered to be semi-controlled device because

(A) it can be turned OFF but not ON with a gate pulse

(B) it conducts only during one half-cycle of an alternating current wave

(C) it can be turned ON but not OFF with a gate pulse

(D) it can be turned ON only during one half-cycle of an alternating voltage wave

18. Natural commutation of a thyristor occurs when

(A) anode current becomes zero

(B) gate current becomes zero

(C) voltage across the device becomes zero

(D) voltage across the device becomes negative

19. In a 3-phase full converter, the output voltage during overlap is equal to

(A) zero

(B) source voltage

(C) source voltage minus the inductance drop

(D) average value of the conducting-phase voltages

20. In a d.c.-to-d.c. converter chopper, for eliminating 3rd harmonic from the output voltage wave, the duty cycle should be equal to

(A) $\frac{1}{5}$ (B) $\frac{1}{4}$

(C) $\frac{1}{3}$ (D) $\frac{1}{2}$

21. A four-quadrant operation requires

(A) two fully controlled converters in series

(B) two fully controlled converters connected back-to-back

(C) two fully controlled converters connected in parallel

(D) two half-controlled converters connected back-to-back

22. Latching current for an SCR, inserted in between a d.c. voltage source of 200 V and a pure inductance of a 0·2 H. The minimum width of gate-pulse current required to turn on the SCR is

(A) 100 μsec (B) 100 msec

(C) 50 msec (D) 0·1 msec

23. A single-phase full-bridge inverter has the d.c. voltage input of 230 V. Find the r.m.s. value of the fundamental component of output voltage.

(A) 90 V (B) 207 V

(C) 196 V (D) 325 V

24. When a buck converter is used in an application like regulated d.c. power supply, then

(A) input voltage remains essentially constant and output voltage is controlled by adjusting the converter duty ratio

(B) input voltage may fluctuate but output voltage is kept constant by adjusting the duty ratio

(C) both input voltage and output voltage are varied by adjusting the converter duty ratio

(D) both input voltage and output voltage are maintained constant by adjusting the converter duty ratio

25. Force-commutated current source inverters need

(A) capacitors for their commutation

(B) inductors for their commutation

(C) diodes for their commutation

(D) only resistors for their commutation

26. The most accurate and versatile method of achieving power factor improvement by reactive power compensation is by using in parallel

(A) thyristor-controlled reactor (TCR) and a fixed capacitor

(B) TCR and a capacitor bank

(C) TCR bank and a thyristor-switched capacitor (TSC)

(D) TCR banks and TSC banks

27. If $A = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix}$, then

(A) $A^2 = 4A + 10I$

(B) $A^3 = 19A + 30I$

(C) $A^4 = 86A + 180I$

(D) All of the above

28. For which value of x, the matrix

$$\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$$

will become singular?

(A) 4

(B) 6

(C) 8

(D) None of the above

29. The value of

$$\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} x^3 \sin^4(x)\,dx$$

is

(A) $\frac{3\pi}{4}$

(B) 4

(C) $\frac{\pi}{4}$

(D) None of the above

30. Let

$$I = \int_C (2zdx + 2ydy + 2xdz)$$

where x, y, z are real and let C be the straight-line segment from point A : (0, 2, 1) to point B : (4, 1, −1). The value of line integral I is

(A) 0

(B) −13

(C) −11

(D) −8

31. The general solution of the differential equation

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 5y = 0$$

in terms of arbitrary constants K_1 and K_2 is

(A) $K_1 e^{(-1+\sqrt{6})x} + K_2 e^{(-1-\sqrt{6})x}$

(B) $K_1 e^{(-1+\sqrt{8})x} + K_2 e^{(-1-\sqrt{8})x}$

(C) $K_1 e^{(-2+\sqrt{6})x} + K_2 e^{(-2-\sqrt{6})x}$

(D) $K_1 e^{(-2+\sqrt{8})x} + K_2 e^{(-2-\sqrt{8})x}$

32. If $u = x^2 + y^2$, where $x = at^2$ and $y = 2at$, then $\frac{du}{dt}$ is equal to

(A) $2at(t + 2)$

(B) 0

(C) $2x + 2y$

(D) $4a^2t(t^2 + 2)$

33. If f and g are analytic functions, then

(A) $\frac{f}{g}$ is always analytic

(B) $\frac{f}{g}$ is analytic, whenever $g(x) \neq 0$

(C) $\frac{f}{g}$ is analytic, whenever $f(x) \neq 0$

(D) None of the above

34. The residue of

$$f(z) = \frac{z^3}{(z-1)^4 (z-2)(z-3)}$$

at $z = 3$ is

(A) 0

(B) –8

(C) $\frac{27}{16}$

(D) $\frac{27}{32}$

35. A box contains 5 black and 5 red balls. Two balls are picked from the box at random one after another without replacement. The probability that both the balls are red is

(A) $\frac{2}{9}$ (B) $\frac{1}{4}$

(C) $\frac{1}{2}$ (D) $\frac{1}{5}$

36. The random inspection of LED bulbs at the output of an LED manufacturing unit of an industry shows 10% defective bulbs. Ten bulbs are picked at random from the warehouse of the industry. Assuming binomial distribution, what is the probability that exactly 2 of the picked LED bulbs are defective?

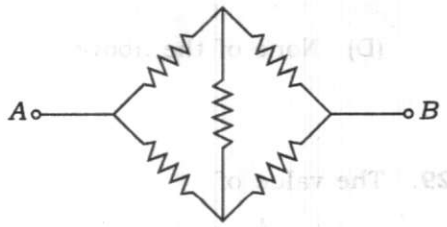
(A) $3{\cdot}645 \times 10^{-7}$

(B) 0·405

(C) 0·1937

(D) 0·01937

37. All resistances of the following circuit are of magnitude 10 Ω :



The equivalent resistance between the terminals A and B of the circuit is

(A) 50 Ω

(B) 20 Ω

(C) 10 Ω

(D) None of the above

38. A circuit delivers energy at the rate of 30 W and 30 VAR (lag) at 230 V, 50 Hz. The power factor of the circuit is

(A) unity

(B) zero

(C) 0·707 (leading)

(D) 0·707 (lagging)

39. A voltage $(3 + j4)$ V is applied across two impedances connected in parallel. If the currents through the impedances are $(1 + j1)$ A and $(0{\cdot}2 - j0{\cdot}6)$ A, then the total impedance of the circuit is

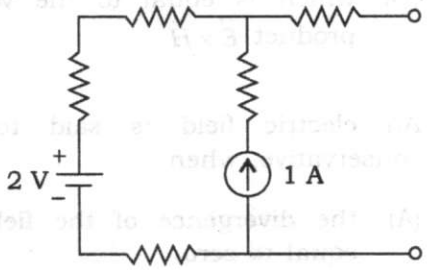
(A) $3{\cdot}2 + 4{\cdot}5j$

(B) $3{\cdot}25j + 2{\cdot}25j$

(C) $2{\cdot}25 + 3{\cdot}5j$

(D) None of the above

40. Consider all resistances of the following circuit of magnitude 2 Ω :



The Thevenin's equivalent voltage source and resistance across terminals A and B are

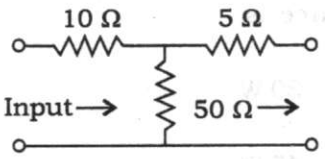
(A) (+) 8 V and 8 Ω

(B) (–) 1·5 V and 3·5 Ω

(C) (–) 4 V and 3·5 Ω

(D) None of the above

41. The driving point impedance Z_{11} (looking from input) and transfer impedance Z_{12} of the following circuit are



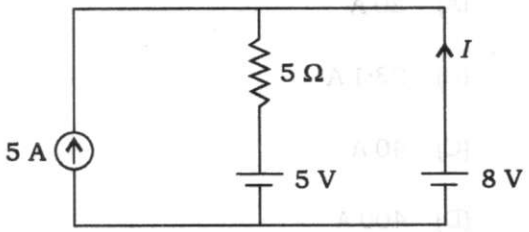
(A) 10 Ω, 5 Ω

(B) 60 Ω, 15 Ω

(C) 60 Ω, 50 Ω

(D) 60 Ω, 55 Ω

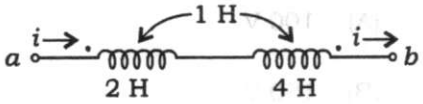
42. The value of the current I shown in the figure below is



(A) 2·2 A (B) –2·2 A

(C) –4·4 A (D) 10 A

43. The effective value of the inductances across ab of the following circuit is



(A) 2 H (B) 4 H

(C) 7 H (D) 5 H

44. Under the condition of maximum power transfer, a voltage source is delivering a power of 30 W to the load. The power generated by the source is

(A) 30 W

(B) 45 W

(C) 60 W

(D) 90 W

45. A balanced star-connected load of $10\angle 36{\cdot}87°\ \Omega$ per phase is connected to a balanced 3-phase, 400 V supply. The line current of the load is

(A) 20 A

(B) 23·1 A

(C) 40 A

(D) 400 A

46. A coil has a resistance of 10 Ω and an inductance of 15 H. The voltage across the terminals of the coil at the instant when the current is 10 A and increasing at a rate 5 A/sec is

(A) 100 V

(B) 150 V

(C) 175 V

(D) 200 V

47. Maxwell's divergence equation for electric field is

(A) $\vec{\nabla}\cdot\vec{E}=\frac{\rho}{\varepsilon_0}$

(B) $\vec{\nabla}\times\vec{E}=\frac{\rho}{\varepsilon_0}$

(C) $\vec{\nabla}\cdot\vec{E}=\frac{\rho}{2\pi\varepsilon_0}$

(D) $\vec{\nabla}\vec{E}=\frac{\rho}{\varepsilon_0}$

48. Vector potential is a vector

(A) whose curl is equal to the magnetic flux density

(B) whose curl is equal to the electric field intensity

(C) whose divergence is equal to the electric potential

(D) which is equal to the vector product $\vec{E}\times\vec{H}$

49. An electric field is said to be conservative, when

(A) the divergence of the field is equal to zero

(B) the curl of the field is equal to zero

(C) the curl of the field is equal to $-\frac{\partial\vec{B}}{\partial t}$

(D) the Laplacian of the field is equal to $\mu\varepsilon\frac{\partial^2\vec{E}}{\partial t^2}$

50. Which of the following expressions is not Maxwell's equation for time-varying fields?

(A) $\vec{\nabla} \times \vec{H} = \vec{J}_C + \vec{J}_D$

(B) $\vec{\nabla} \cdot \vec{D} = \rho_V$

(C) $\vec{\nabla} \cdot \vec{E} = -\frac{\partial \vec{B}}{\partial t}$

(D) $\oint \vec{B} \cdot d\vec{S} = 0$

51. Which law was given by Maxwell for the correction of the inconsistency of continuity equation for the time-varying field?

(A) Ampere's circuital law

(B) Gauss' law

(C) Faraday's law

(D) None of the above

52. According to Gauss' law of electro-statics

(A) total flux out of a closed surface is equal to the net charge within the surface

(B) flux at any point in the hollow region of a hollow charged sphere is zero

(C) flux at any point in the hollow region between two concentric hollow charged spheres is only due to the charge present on the inner hollow sphere

(D) All of the above

53. Which of the following is the Poisson's equation for a linear and isotropic but inhomogeneous medium?

(A) $\nabla^2 \vec{E} = -\frac{\rho}{\varepsilon}$

(B) $\vec{\nabla} \cdot \vec{\nabla}(\varepsilon V) = -\rho$

(C) $\vec{\nabla} \cdot (\varepsilon \vec{\nabla} V) = -\rho_V$

(D) $\nabla^2 V = -\frac{\rho}{\varepsilon}$

54. Permittivity is expressed in

(A) F/m^2

(B) F/m

(C) Wb/m

(D) V/m

55. The Biot-Savart law is a general modification of

(A) Gauss' law

(B) Coulomb's law

(C) Faraday's law

(D) Ampere's law

56. Electric field inside a hollow metallic charged sphere is

(A) increasing towards centre

(B) decreasing towards centre

(C) uniform in everywhere

(D) zero

57. For input $x(t)$, an ideal impulse system produces the output

$$y(t) = \sum_{k=-\infty}^{\infty} x(kT)\delta(t - kT)$$

where $\delta(t)$ is the Dirac delta function. The system is

(A) non-linear and time invariant

(B) non-linear and time varying

(C) linear and time invariant

(D) linear and time varying

58. Let $f(t)$ be a continuous-time signal and let $F(\omega)$ be its Fourier transform defined by

$$F(\omega) = \int_{-\infty}^{\infty} f(t)e^{-j\omega t}\,dt$$

and let $g(t)$ be a function given by

$$g(t) = \int_{-\infty}^{\infty} F(u)e^{-jut}\,du$$

The relationship between $f(t)$ and $g(t)$ is

(A) $g(t)$ would always be proportional to $f(t)$

(B) $g(t)$ would be proportional to $f(t)$, if $f(t)$ is an even function

(C) $g(t)$ would be proportional to $f(t)$, if $f(t)$ is a sinusoidal function

(D) $g(t)$ would never be proportional to $f(t)$

59. A continuous-time LTI system is given by

$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = 2\frac{dx(t)}{dt} + 4x(t)$$

Assuming zero initial conditions, the response $y(t)$ of the above system for the input $x(t) = e^{-2t}u(t)$ is given by

(A) $(e^t - e^{3t})u(t)$

(B) $(e^{-t} + e^{-3t})u(t)$

(C) $(e^{-t} - e^{-3t})u(t)$

(D) $(e^t + e^{3t})u(t)$

60. The transfer function of a discrete-time system is given by

$$H(z^{-1}) = \frac{b_0}{1 - z^{-1} + a_2 z^{-2}}$$

where a_2 is real. The transfer function is BIBO stable if the value of a_2 is

(A) 0·5

(B) −0·75

(C) −1·5

(D) 1·5

61. Pick the incorrect statement from the options given below.

(A) $x[n] = \sin(\omega_0 n) \cdot u[n]$ is a power signal.

(B) $x[n] = e^{-|n|}$ is an energy signal.

(C) $x[n] = nu[n]$ is neither energy signal nor power signal.

(D) None of the above

62. Z-transform of unit-step sequence $u[n]$ is

(A) $\frac{1}{z-1}$

(B) $\frac{z}{z-1}$

(C) $\frac{z+1}{z}$

(D) $\frac{z}{z+1}$

63. The trigonometric Fourier series of an even function of time does not have

(A) d.c. term

(B) cosine term

(C) sine term

(D) odd harmonic term

64. Consider the analog signal

$x(t) = 3\cos(50\pi t) + 10\sin(300\pi t) - \cos(100\pi t)$

The Nyquist rate for the signal is

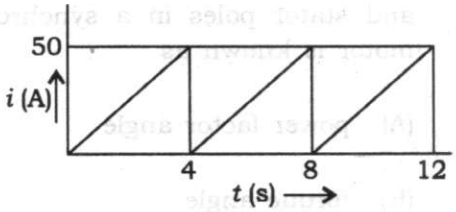
(A) 50 Hz

(B) 100 Hz

(C) 150 Hz

(D) 300 Hz

65. The average value of current i is



(A) 25 A

(B) 50 A

(C) 100 A

(D) 200 A

66. Laplace transform of $f(t)$ is $\frac{1}{s+2}$. Then the $f(t)$ is

(A) $\sin(2t)$

(B) $\cos(2t)$

(C) e^{-2t}

(D) $t \cdot e^{-2t}$

67. A 440 V, 3-phase, 10-pole and 50 Hz synchronous motor delivering a torque of $\frac{50}{\pi}$ N m delivers a power of

(A) 440 W

(B) 500 W

(C) 600 W

(D) 1000 W

68. The angle between the rotor poles and stator poles in a synchronous motor is known as

(A) power factor angle

(B) torque angle

(C) synchronizing angle

(D) angle of retardation

69. A 4-pole, wave-wound d.c. machine armature has 880 conductors and delivers 120 A. The brushes have been displaced through 3 angular degrees from the geometrical axes. The demagnetizing amp-turns/pole is

(A) 440

(B) 880

(C) 1460

(D) 6160

70. The polarity of a d.c. generator can be reversed by

(A) reversing the field current

(B) increasing the field current

(C) reversing field current as well as direction of rotation

(D) Any of the above

71. For which of the following applications a d.c. motor is preferred over an a.c. motor?

(A) Low-speed operation

(B) High-speed operation

(C) Variable-speed operation

(D) Constant-speed operation

72. The phasor diagram of a transformer shows all voltage and current phasors relative to

(A) core magnetic flux phasor

(B) primary input voltage phasor

(C) no-load current phasor

(D) core loss component of the no-load current phasor

73. In case of a short-circuit test of a transformer

(A) high-voltage winding is short-circuited and low-voltage winding is energized

(B) high-voltage winding is open-circuited and low-voltage winding is short-circuited

(C) high-voltage winding is short-circuited and low-voltage winding is open-circuited

(D) high-voltage winding is energized and low-voltage winding is short-circuited

74. DC series motors are used in those applications where it is desired to have

(A) low starting torque

(B) practically constant speed

(C) high no-load speed

(D) high starting torque

75. The reversal of speed of motor used as a method of electric braking is called as

(A) regenerative braking

(B) dynamic or rheostatic braking

(C) plugging or counter-current braking

(D) inductive braking

76. A squirrel-cage type, 3-phase, 50 Hz, 4-pole induction motor is running on full-load and develops a torque of 200 N m at the shaft when the rotor e.m.f. makes 150 complete cycles per minute. If the mechanical torque lost in friction and core loss is 10 N m, and the total stator loss is 1000 W, the shaft power output is

(A) 19896·75 W

(B) 29845·13 W

(C) 31415·93 W

(D) 1570·80 W

77. In order to eliminate sheath losses in underground cables, a successful method is

(A) to transpose the cable along with cross-bonding

(B) to transpose the cables only

(C) cross-bonding of the cables is enough

(D) None of the above

78. Protection scheme used for loss of excitation of a very large generation unit feeding power into a grid employs

(A) undervoltage relay

(B) offset mho relay

(C) underfrequency relay

(D) percentage differential relay

79. Load frequency control is achieved by properly matching the individual machine's

(A) reactive powers

(B) generated voltages

(C) turbine inputs

(D) turbine and generator ratings

80. Equal area criterion gives the information regarding

(A) stability region

(B) absolute stability

(C) relative stability

(D) swing curves

81. A hydel power plant of run-off-river type should be provided with a pondage so that the

(A) firm capacity of the plant is increased

(B) operating head is controlled

(C) pressure inside the turbine casing remains constant

(D) kinetic energy of the running water is fully utilized

82. Resistance grounding is used for voltage between

(A) 33 kV to 66 kV

(B) 11 kV to 33 kV

(C) 3·3 kV to 11 kV

(D) None of the above

83. A 200 bus power system has 160 PQ buses. For achieving a load flow solution by Newton-Raphson polar coordinates, the minimum number of simultaneous equations to be solved is

(A) 334

(B) 357

(C) 359

(D) 398

84. A single area consists of two generation units with speed regulation (R) values 0·1 p.u. and 0·08 p.u. The per unit load change is 0·09 p.u. All per unit values are on a common base. If there is no frequency dependent load, the steady-state frequency deviation is

(A) −0·004 p.u.

(B) −0·04 p.u.

(C) −0·4 p.u.

(D) −0·008 p.u.

85. A 50 Hz, four-pole turbogenerator rated 20 MVA, 13·2 kV has an inertia constant $H = 9{\cdot}0$ kW-sec/kVA. Kinetic energy stored in the rotor at synchronous speed is

(A) 90 MJ

(B) 18 MJ

(C) 180 MJ

(D) 2·2 MJ

86. In power flow analysis for a voltage controlled bus, which one of the following is unknown?

(A) Real power

(B) Reactive power

(C) Absolute value of voltage

(D) None of the above

87. The open-loop transfer function of a feedback control system is given by

$$T(s) = \frac{K}{s(s+6)^2}$$

The breakaway point on the root locus is

(A) (–) 2

(B) (–) 6

(C) (–) 4

(D) (–) 12

88. In case of assessment of stability using Bode plot, which one of the following is most appropriate?

(A) The system is said to be stable if gain margin and phase margin are both negative

(B) The system is said to be stable if gain margin is zero and phase margin is negative

(C) The system is said to be stable if gain margin and phase margin are both positive

(D) The system is said to be stable if gain margin is positive and phase margin is negative

89. A unity negative feedback control system has the open-loop transfer function

$$G(s)H(s) = \frac{16}{s(s+6)}$$

The closed-loop system is

(A) unstable

(B) underdamped, i.e., damped oscillatory

(C) overdamped

(D) critically damped

90. The transfer function of a first-order system is

$$T(s) = \frac{10}{s+5}$$

The time constant of the system is

(A) 0·2 sec

(B) 2 sec

(C) 5 sec

(D) 10 sec

91. Which of the following statements is most appropriate?

(A) The number of poles at the origin is said to be type of a transfer function.

(B) The total number of poles is said to be order of a transfer function.

(C) If poles of open-loop transfer function lie in right-half s-plane, the system response will be increasing and oscillatory as time increases.

(D) All of the above

92. The state-space model of a system is given by the following equations :

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix}=\begin{bmatrix}-1 & 1 & 0\\ 0 & -1 & 0\\ 0 & 0 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}+\begin{bmatrix}0\\ 4\\ 0\end{bmatrix}u$$

$$y=\begin{bmatrix}1 & 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

The system is

(A) controllable

(B) observable

(C) unobservable

(D) Both (A) and (B)

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

$$C_1=\frac{10(s+1)}{s+10} \text{ and } C_2=\frac{s+10}{10(s+1)}$$

Which of the following statements is most appropriate?

(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.

94. A derivative controller in the system

(A) decreases the damping as well as the settling time

(B) decreases the damping but increases the settling time

(C) increases the damping but decreases the settling time

(D) increases the damping as well as the settling time

95. The state matrix of an autonomous state model is given by

$$A = \begin{bmatrix} 0 & 2 \\ 8 & 0 \end{bmatrix}$$

The poles of the corresponding system are located at

(A) $j2, -j2$

(B) $-2, -8$

(C) $j4, -j4$

(D) $4, -4$

96. In a Bode magnitude plot, which one of the following slopes would be exhibited at high frequencies by a 4th-order all-pole system?

(A) −40 dB/decade

(B) 40 dB/decade

(C) −80 dB/decade

(D) 80 dB/decade

97. A moving-iron instrument can be used for

(A) d.c. only

(B) a.c. only

(C) both d.c. and a.c.

(D) None of the above

98. The pressure coil of a wattmeter should be connected on the supply side of the current coil when

(A) load impedance is high

(B) load impedance is low

(C) supply voltage is low

(D) None of the above

99. Which of the following types of instrument is used to measure very small currents of high frequency?

(A) Induction type instrument

(B) Dynamometer type instrument

(C) Permanent magnet moving-coil type instrument

(D) Thermocouple type instrument

100. Schering bridge can be used for

(A) measuring voltages

(B) measuring currents

(C) testing capacitors

(D) protecting the circuit from temperature rises

SPACE FOR ROUGH WORK