

Name of Post:	Assistant Manager (Electrical, Mechanical & Civil) in Assam Electricity Grid Corporation Limited (AEGCL)
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AM/AEGCL/EE/23

E ASKED TO DO SO

Test Booklet No. :

Series

01124

TEST BOOKLET
Paper—II
(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.

/12-D

[No. of Questions : 100]

SEAL

1. The impulse response of a discrete-time LTI system is $h[n]$. The condition for BIBO stability is

(A) $\sum_{k=-\infty}^{\infty} h[k] = 0$

(B) $\sum_{k=-\infty}^{\infty} [h[k]]^2 < \infty$

(C) $\sum_{k=-\infty}^{\infty} |h[k]| < \infty$

(D) $\sum_{k=-\infty}^{\infty} h[k] < \infty$

2. The discrete-time Fourier transform is periodic with period

(A) π (B) 2π

(C) $\pi/2$ (D) $\pi/4$

3. The Fourier series of a real periodic function has only

P : cosine terms if it is even

Q : sine terms if it is even

R : cosine terms if it is odd

S : sine terms if it is odd

Which of the above are correct?

(A) P and S

(B) P and R

(C) Q and S

(D) Q and R

4. The impulse response of a continuous time system is given by

$$h(t) = \delta(t-1) + \delta(t-3)$$

The value of the step response at $t=2$ is

(A) zero

(B) 1

(C) 2

(D) 3

5. The region of convergence of the z-transform of the discrete-time signal $x[n] = 2^n u[n]$ will be

(A) $|z| > 2$

(B) $|z| < 2$

(C) $|z| > \frac{1}{2}$

(D) $|z| < \frac{1}{2}$

6. The Nyquist sampling rate for the signal

$$s(t) = \frac{\sin(500\pi t)}{\pi t} \times \frac{\sin(700\pi t)}{\pi t}$$

is given by

(A) 400 Hz

(B) 600 Hz

(C) 1200 Hz

(D) 1400 Hz

7. If the notation $*$ is used to denote the convolution, $X(\omega)$ and $Y(\omega)$ are the Fourier transforms of $x(t)$ and $y(t)$, respectively, then the Fourier transform of $x(t)*y(t)$ is

(A) $X(\omega)Y(\omega)$

(B) $X(\omega) * Y(\omega)$

(C) $\frac{1}{2\pi}X(\omega)Y(\omega)$

(D) $\frac{1}{2\pi}[X(\omega) * Y(\omega)]$

8. In an electromechanical energy conversion device, the developed torque depends upon

(A) stator field strength and torque angle

(B) stator field strength and rotor field strength

(C) stator field strength, rotor field strength and torque angle

(D) stator field strength only

9. The current drawn by a 220 V d.c. motor of armature resistance 0.5Ω and back e.m.f. 200 V is

(A) 40 A

(B) 44 A

(C) 400 A

(D) 440 A

10. If the field winding of a d.c. motor is opened while running, then

(A) the armature current will reduce

(B) the speed of the motor will reduce

(C) the motor will attain dangerously high speed

(D) the motor will continue to run at constant speed

11. If a d.c. motor is disconnected from the source and armature circuit is short-circuited through a suitable resistance, the process is called

(A) regenerative braking

(B) rheostatic braking

(C) dynamic braking

(D) No braking is possible

12. The purpose of inserting external resistance in series with the armature winding at the time of starting a d.c. motor is to

(A) increase the starting torque

(B) increase the armature flux

(C) reduce the armature flux

(D) reduce the starting current

13. A single-phase transformer when supplied from 220 V, 50 Hz has eddy current loss of 50 W. If the transformer is connected to a voltage source of 330 V, 50 Hz, then the eddy current loss will be

(A) 168.75 W (B) 112.5 W

(C) 75 W (D) 50 W

14. During SC test, the iron loss of a transformer is negligible because

- (A) the entire input power is just sufficient to meet copper losses only
- (B) the flux produced is a small fraction of the normal flux
- (C) iron core becomes fully saturated
- (D) supply frequency is held constant

15. A 500 kVA transformer has constant losses of 500 W and copper losses at full load are 2000 W. At what load is the efficiency maximum?

- (A) 250 kVA
- (B) 500 kVA
- (C) 1000 kVA
- (D) 125 kVA

16. The full-load copper loss and iron loss of a transformer are 1000 W and 500 W, respectively. The copper and iron losses at 50% loading of the transformer will be respectively

- (A) 500 W and 500 W
- (B) 250 W and 500 W
- (C) 250 W and 250 W
- (D) 500 W and 250 W

17. Two 10 kV/440 V, 1-phase transformers of ratings 600 kVA and 350 kVA are connected in parallel to share a load of 800 kVA. The reactances of the transformers, referred to secondary side, are 0.0198Ω and 0.0304Ω , respectively (resistance negligible). The load shared by the two transformers will be respectively

- (A) 484.5 kVA and 315.5 kVA
- (B) 315.5 kVA and 484.5 kVA
- (C) 533 kVA and 267 kVA
- (D) 267 kVA and 533 kVA

18. A single-phase, 10 kVA, 2000/200 V, 50 Hz transformer is connected to form an auto-transformer as shown in Fig. 5. What are the values of V_1 and I_2 , respectively?

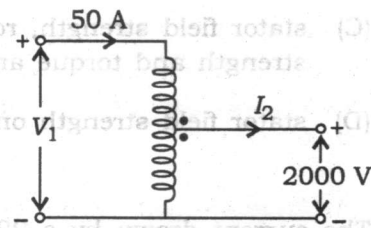


Fig. 5

- (A) 2200 V, 55 A
- (B) 2200 V, 45 A
- (C) 2000 V, 45 A
- (D) 1800 V, 45 A

19. An induction motor having 8 poles runs at 727.5 r.p.m. If the supply frequency is 50 Hz, the e.m.f. in the rotor will have a frequency of

- (A) 50 Hz
- (B) 75 Hz
- (C) 1.5 Hz
- (D) 51.5 Hz

20. The crawling in the IM is caused by

- (A) improper design of the machine
- (B) low supply voltage
- (C) high load
- (D) harmonics developed in the motor

21. If two induction motors A and B are identical except that the air gap of motor A is 50% greater than that of motor B, then

- (A) the no-load power factor of A will be better than that of B
- (B) the no-load power factor of A will be poorer than that of B
- (C) the core losses of A will be more than that of B
- (D) the operating flux of A will be smaller than that of B

22. What are the conditions to be satisfied for an alternator to be synchronized with an incoming supply?

- 1. Equal voltage
- 2. Equal frequency
- 3. Same power rating
- 4. Same phase sequence

Select the correct answer using the code given below.

- (A) 2, 3 and 4
- (B) 3 and 4
- (C) 1, 2 and 3
- (D) 1, 2 and 4

23. If the excitation of a 3-phase alternator operating on infinite bus-bars is changed, then which one of the following shall alter?

- (A) Active power of the machine
- (B) Reactive power of the machine
- (C) Terminal voltage of the machine
- (D) Frequency of the machine

24. A 3-phase, 11 kV, 5 MVA alternator has synchronous reactance of 10 Ω per phase. Its excitation is such that the generated e.m.f. is 14 kV. If the alternator is connected to an infinite busbar, the maximum output at the given excitation is

- (A) 15400 kW
- (B) 8000 kW
- (C) 6200 kW
- (D) 5135 kW

25. Which 3-phase connection can be used in a transformer to introduce a phase difference of 30° between its output and corresponding input line voltages?

- (A) Star-star
- (B) Star-delta
- (C) Delta-delta
- (D) Delta-zigzag

26. A generating station has connected load of 500 MW and maximum demand of 200 MW. The demand factor of the station will be

- (A) 0.4
- (B) 2.5
- (C) 0.5
- (D) 0.2

27. The output from a hydroelectric power plant depends on

- (A) head, type of dam and discharge
- (B) type of catchment area, dam and discharge
- (C) type of draft tube, turbine and efficiency of the system
- (D) head, discharge and efficiency of the system

28. The surge impedance of a 3-phase, 400 kV transmission line is 400Ω . The surge impedance loading (SIL) is

- (A) 400 MW
- (B) 100 MW
- (C) 1600 MW
- (D) 200 MW

29. Two 50 Hz generating units operate in parallel within the same power plant and have the following ratings :

Unit-1 : 500 MVA, 0.85 power factor, 20 kV, 3000 r.p.m., $H_1 = 5 \text{ MJ/MVA}$

Unit-2 : 200 MVA, 0.9 power factor, 20 kV, 1500 r.p.m., $H_2 = 5 \text{ MJ/MVA}$

The equivalent inertia constant H in MJ/MVA on 100 MVA base is

- (A) 2.5
- (B) 5.0
- (C) 10
- (D) 35

30. In a short transmission line, voltage regulation is zero when the power factor angle of the load at the receiving-end side is equal to

(A) $\tan^{-1}\left(\frac{X}{R}\right)$

(B) $\tan^{-1}\left(\frac{R}{X}\right)$

(C) $\tan^{-1}\left(\frac{X}{Z}\right)$

(D) $\tan^{-1}\left(\frac{R}{Z}\right)$

31. The Ferranti effect on long overhead line is experienced when

- (A) the line is lightly loaded
- (B) the line is heavily loaded
- (C) the line is on full load
- (D) power factor is unity

32. Series capacitor can be used in distribution lines

- (A) to provide reactive power compensation
- (B) to reduce the receiving-end voltage under light load conditions
- (C) to reduce the voltage drops
- (D) to reduce the line losses

33. Two insulator discs of identical capacitance value C make up a string for a 22 kV, 50 Hz, single-phase overhead line insulation system. If the pin to earth capacitance is also C , then the string efficiency is

- (A) 50%
- (B) 75%
- (C) 90%
- (D) 86%

34. In the network as shown in Fig. 6, the marked parameters are p.u. impedances. The bus admittance matrix of the network is

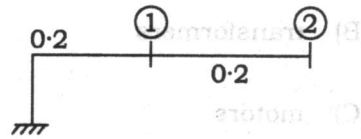


Fig. 6

(A) $\begin{bmatrix} 10 & -5 \\ -5 & 5 \end{bmatrix}$

(B) $\begin{bmatrix} 5 & -5 \\ -5 & 10 \end{bmatrix}$

(C) $\begin{bmatrix} -10 & 5 \\ 5 & -5 \end{bmatrix}$

(D) $\begin{bmatrix} -5 & 5 \\ 5 & -10 \end{bmatrix}$

35. 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 matrix is

(A) 189×189

(B) 100×100

(C) 90×90

(D) 180×180

36. Differential relay is used for

- (A) generators
- (B) transformers
- (C) motors
- (D) All of the above

37. Which is the main relay for protecting up to 90% of the transmission line length in the forward direction?

- (A) Directional over-current relay
- (B) Mho relay
- (C) Carrier current protective relay
- (D) Impedance relay

38. For which one of the following types of motors is the equal area criterion for stability applicable?

- (A) Three-phase synchronous motor
- (B) Three-phase induction motor
- (C) DC series motor
- (D) DC compound motor

39. The total reactance and total susceptance of a lossless overhead EHV line, operating at 50 Hz, are given by 0.045 p.u. and 1.2 p.u., respectively. If the velocity of wave propagation is 3×10^5 km/s, then the approximate length of the line is

- (A) 122 km
- (B) 172 km
- (C) 222 km
- (D) 272 km

40. SF₆ gas has excellent heat transfer properties because of

- (A) its higher molecular weight
- (B) its low gaseous viscosity
- (C) its higher dielectric strength
- (D) the combination of (A) and (B)

41. The incremental cost characteristics of two generators delivering a total load of 200 MW are as follows :

$$\frac{dF_1}{dP_1} = 2.0 + 0.01P_1; \quad \frac{dF_2}{dP_2} = 1.6 + 0.02P_2$$

What should be the values of P_1 and P_2 for economic operation?

- (A) $P_1 = P_2 = 100$ MW
- (B) $P_1 = 80$ MW, $P_2 = 120$ MW
- (C) $P_1 = 200$ MW, $P_2 = 0$
- (D) $P_1 = 120$ MW, $P_2 = 80$ MW

42. In coal-fired thermal power station, what are the electrostatic precipitators used for?

- (A) To remove dust particles setting on the busbar conductors in the station switchyard
- (B) To condense steam by electrostatic means
- (C) To keep the air heaters clean
- (D) To collect the dust particles from the flue gases

43. $Z_{p.u.}^{Old}$ is the per unit impedance on the power base S_B^{Old} and voltage base V_B^{Old} . What would be the per unit impedance on the new power base S_B^{New} and voltage base V_B^{New} ?

(A) $Z_{p.u.}^{New} = Z_{p.u.}^{Old} \left(\frac{S_B^{Old}}{S_B^{New}} \right) \left(\frac{V_B^{New}}{V_B^{Old}} \right)^2$

(B) $Z_{p.u.}^{New} = Z_{p.u.}^{Old} \left(\frac{S_B^{New}}{S_B^{Old}} \right) \left(\frac{V_B^{Old}}{V_B^{New}} \right)^2$

(C) $Z_{p.u.}^{New} = Z_{p.u.}^{Old} \left(\frac{S_B^{New}}{S_B^{Old}} \right) \left(\frac{V_B^{Old}}{V_B^{New}} \right)$

(D) $Z_{p.u.}^{New} = Z_{p.u.}^{Old} \left(\frac{S_B^{Old}}{S_B^{New}} \right) \left(\frac{V_B^{New}}{V_B^{Old}} \right)$

44. A 100 km long transmission line is loaded at 110 kV. If the loss of the line is 15 MW and load is 150 MVA, the resistance of the line is

- (A) 8.06 Ω /phase
- (B) 0.806 Ω /phase
- (C) 0.0806 Ω /phase
- (D) 80.6 Ω /phase

45. In HVDC transmission, there are predominant

- (A) voltage harmonics on d.c. side and current harmonics on a.c. side of converters
- (B) current harmonics on d.c. side and voltage harmonics on a.c. side of converters
- (C) current harmonics only on the d.c. side of converters
- (D) voltage harmonics only on the a.c. side of converters

46. Negative feedback in a closed-loop control system does not

- (A) reduce the overall gain
- (B) reduce bandwidth
- (C) improve disturbance rejection
- (D) reduce sensitivity to parameter variation

47. The open-loop transfer function of a unit feedback control system is

$$GH(s) = \frac{5}{s(s+4)}$$

The closed-loop poles are

- (A) $-2+j$ and $-2-j$
 (B) 0 and -4
 (C) 0, $-2+j$ and $-2-j$
 (D) $2-j$ and $2+j$
48. A linear second-order control system with characteristic equation

$$s^2 + 16s + 49 = 0$$

is initially at rest and subjected to a step input signal. The response of the system will exhibit a peak overshoot of

- (A) 16%
 (B) 9%
 (C) zero
 (D) infinity
49. The open-loop transfer function of a unity feedback control system is

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

and the system is unstable for

- (A) $0 < K < 36$
 (B) $K > 36$
 (C) $K < 36$
 (D) $K = 36$

50. A control system has the open-loop transfer function

$$GH(s) = \frac{K}{s(s+3)(s+4)}$$

The root loci intersect the imaginary axis at

- (A) 0 and $j\sqrt{12}$
 (B) 0 and $-j\sqrt{12}$
 (C) $j\sqrt{12}$ and $-j\sqrt{12}$
 (D) $j12$ and $-j12$

51. The slope of the asymptotic Bode magnitude plot for the transfer function

$$G(j\omega) = \frac{100}{(j\omega)^2}$$

is

- (A) -40 dB/decade
 (B) -20 dB/decade
 (C) $+20$ dB/decade
 (D) $+40$ dB/decade

52. The state equation of a linear system is given by

$$\frac{dx}{dt} = Ax + Bu$$

The state transition matrix of the system is

- (A) $\begin{bmatrix} e^{2t} & 0 \\ 0 & e^{2t} \end{bmatrix}$
 (B) $\begin{bmatrix} e^{-2t} & 0 \\ 0 & e^{-2t} \end{bmatrix}$
 (C) $\begin{bmatrix} \sin 2t & \cos 2t \\ -\cos 2t & \sin 2t \end{bmatrix}$
 (D) $\begin{bmatrix} \cos 2t & \sin 2t \\ -\sin 2t & \cos 2t \end{bmatrix}$

53. The transfer function

$$\frac{1+0.5s}{1+s}$$

represents a

- (A) lag network
- (B) lead network
- (C) proportional controller
- (D) lead-lag controller

54. An ammeter has a current range of (0–5) A and its internal resistance is 0.2Ω . In order to change the range as (0–25) A, we need to add a resistance of

- (A) 0.8Ω in series with the meter
- (B) 1.0Ω in series with the meter
- (C) 0.04Ω in parallel with the meter
- (D) 0.05Ω in parallel with the meter

55. A 0 to 300 V voltmeter has an error $\pm 2\%$ for full-scale reading. What is the range of reading if true voltage is 30 V?

- (A) 24–36 V
- (B) 20–40 V
- (C) 29.4–30.6 V
- (D) None of the above

56. The bridge used for measurement of capacitance is

- (A) Wheatstone bridge
- (B) Wien's bridge
- (C) Hay's bridge
- (D) Schering bridge

57. Two voltmeters of same range, one moving iron (MI) and the other is PMMC type, are connected in parallel for measuring a.c. supply voltage. If the reading of MI type is 230 V, the reading of PMMC type is

- (A) 230 V
- (B) higher than MI type
- (C) zero
- (D) None of the above

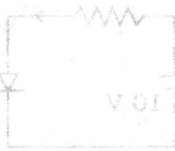
58. In a balanced 3-phase system, power is measured by two-wattmeter method. The ratio of wattmeter readings is 2 : 1. The power factor of the system is

- (A) unity
- (B) 0.866 lagging
- (C) 0.707 lagging
- (D) 0.5 lagging

59. An energy meter having a meter constant of 1200 rev/kWh is found to make 5 revolutions in 75 seconds. The total power is
- (A) 500 W
(B) 200 W
(C) 100 W
(D) 1000 W
60. In electro-dynamometer type watt-meter, the induction of pressure coil produces error. This error is
- (A) constant irrespective of the power factor of the load
(B) higher at higher power factor load
(C) higher at lower power factor load
(D) higher at unity power factor load
61. An LVDT is used for measuring 1 mm displacement. For this purpose, a voltmeter of range 0 to 2 V is connected at the output of the LVDT through an amplifier having a gain of 500. Determine the sensitivity of the LVDT if the output is 2 mV.
- (A) 0.1 V/mm
(B) 0.05 V/mm
(C) 1 V/mm
(D) 0.5 V/mm
62. An operational amplifier possesses
- (A) very large input and output resistance
(B) very large input resistance and very small output resistance
(C) very small input and output resistance
(D) very small input resistance and very large output resistance
63. An amplifier has voltage gain of 15 dB. If the input signal voltage is 0.8 V, the output voltage is
- (A) 4.5 V
(B) 4.0 V
(C) 8.0 V
(D) 12.0 V
64. The binary equivalent of hexadecimal number 4FAD is
- (A) 0101 1111 0010 1100
(B) 0100 1111 0010 1100
(C) 0100 1111 1010 1101
(D) 0100 1110 0010 1101
65. The Boolean expression
- $$Y = (A + B)(A + C)$$
- is equivalent to
- (A) $AB + C$ (B) $AC + B$
(C) $A + BC$ (D) ABC

66. The number of 2×1 multiplexers required to implement a 16×1 multiplexer is

- (A) 8
- (B) 4
- (C) 15
- (D) 16



67. The outputs S and C of the digital circuit shown in Fig. 7, for $A=0$ and $B=1$, are

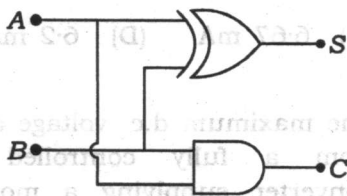


Fig. 7

- (A) $S=0$ and $C=1$
- (B) $S=1$ and $C=0$
- (C) $S=0$ and $C=0$
- (D) $S=1$ and $C=1$

68. If the a.c. voltage input is 10 V r.m.s., the maximum voltage that will appear across the diode of a half-wave rectifier with a capacitor input filter will be

- (A) 10 V
- (B) 14 V
- (C) 20 V
- (D) 30 V

69. Which among the following is an example for a voltage bidirectional two-quadrant switch?

- (A) SCR
- (B) BJT
- (C) Diode
- (D) MOSFET

70. The input voltage of Zener regulator varies from 20 V to 30 V. The load current varies from 10 mA to 15 mA. If the Zener voltage is 5 V, the value of the series resistor will be (Assume $I_{ZK} = 0$)

- (A) 1 k Ω
- (B) 1.5 k Ω
- (C) 1.66 k Ω
- (D) 2.5 k Ω

71. A step-up chopper is fed with 200 V. The conduction time of the thyristor is 200 μ s and the required output is 600 V. If the frequency of the operation is kept constant and the pulse width is halved, what will be the new output voltage?

- (A) 600 V
- (B) 300 V
- (C) 400 V
- (D) 200 V

72. Which is the power semiconductor device having highest switching speed?

- (A) SCR
- (B) CMOS
- (C) IGBT
- (D) MOSFET

73. An SCR is used for converting a.c. to d.c. The anode supply is 230 V, 50 Hz and the firing angle is adjusted to 60°. The d.c. output voltage is

- (A) 230 V
- (B) 162.6 V
- (C) 78 V
- (D) 115 V

74. Which phenomenon is present in thyristor but absent in BJT, MOSFET and IGBT?

- (A) Forward conduction
- (B) Forward blocking
- (C) Reverse breakdown
- (D) Latching

75. The $i-v$ characteristics of the diode in the circuit shown in Fig. 8 are

$$i = \begin{cases} \frac{v-0.7}{500} \text{ A}, & v \geq 0.7 \text{ V} \\ 0, & v < 0.7 \text{ V} \end{cases}$$

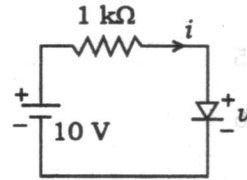


Fig. 8

The current in the circuit is

- (A) 10 mA
- (B) 9.3 mA
- (C) 6.67 mA
- (D) 6.2 mA

76. The maximum d.c. voltage available from a fully controlled bridge converter supplying a motor and operating from low-impedance 230 V main is

- (A) 207 V
- (B) 230 V
- (C) 115 V
- (D) 146 V

77. A thyristor can be fired with $\frac{dv}{dt}$ of 200 V/ μ s. If the forward breakover current of the device is 5 mA, the value of diffusion capacitance is given by

- (A) 25 pF
- (B) 2.5 pF
- (C) 25 μ F
- (D) 2.5 μ F

78. A series circuit contains n linear identical resistors each with a value of R and the circuit is connected to a d.c. voltage source of V . If the values of all resistors are halved, then the voltage across each resistor will be

- (A) $V/(2n)$
- (B) $2V/n$

(C) V/n
 (D) V/n^2

79. A d.c. circuit shown in Fig. 1 has a voltage source V , a current source I and several resistors. A particular resistor R dissipates a power of 2 watts when V alone is active. The same resistor dissipates a power of 8 watts when I alone is active. The power dissipated by R when both the sources are active will be

- (A) 10 watts
- (B) 18 watts
- (C) 6 watts
- (D) zero watt

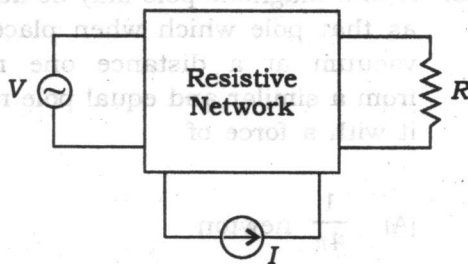


Fig. 1

80. In the circuit shown in Fig. 2, the value of R_L such that the power transferred to R_L is maximum is

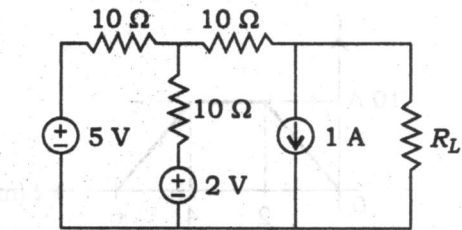


Fig. 2

- (A) 5 Ω
- (B) 10 Ω
- (C) 15 Ω
- (D) 20 Ω

81. How many 200 W, 220 V incandescent lamps connected in series would consume the same total power as a single 100 W, 220 V incandescent lamp can consume?

- (A) Not possible
- (B) 4
- (C) 3
- (D) 2

82. Applying the Thevenin's theorem, the voltage obtained across the terminal AB in Fig. 3 is

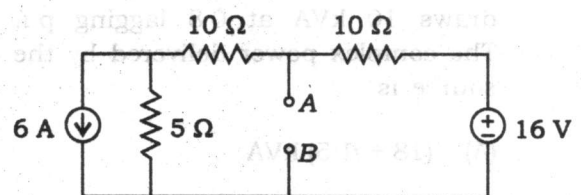


Fig. 3

- (A) 1.5 V
- (B) -1.5 V
- (C) 14 V
- (D) 16 V

83. A current shown in Fig. 4 passes through a pure inductance of 3 mH. The instantaneous power in watt during $0 < t < 2$ ms is

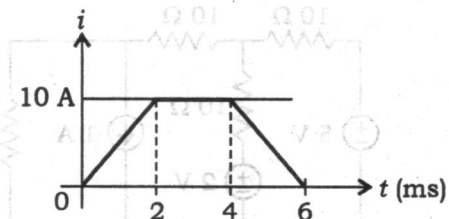


Fig. 4

- (A) $25000t$ (B) $75000t$
 (C) $5000t$ (D) $10000t$
84. The maximum value of mutual inductance of two inductively coupled coils with self-inductances $L_1 = 49$ mH and $L_2 = 64$ mH is
 (A) 56 mH
 (B) 113 mH
 (C) 15 mH
 (D) 3136 mH
85. A 230 V source supplies power to two loads connected in parallel. The first load draws 10 kW at 0.8 leading p.f. and the second load draws 10 kVA at 0.8 lagging p.f. The complex power delivered by the source is
 (A) $(18 + j1.5)$ kVA
 (B) $(18 - j1.5)$ kVA
 (C) $(20 + j1.5)$ kVA
 (D) $(20 - j1.5)$ kVA

86. In a single-phase circuit
 $v(t) = 120 \sin(314t + 45^\circ)$ V
 $i(t) = 10 \sin(314t - 10^\circ)$ A

The average power absorbed by the circuit is

- (A) 1200 W (B) 983 W
 (C) 688 W (D) 344 W
87. A non-ideal voltage source V_s has an internal impedance of Z_s . If a pure resistive load is to be chosen that maximizes the power transferred to the load, its value must be
 (A) zero
 (B) real part of Z_s
 (C) magnitude of Z_s
 (D) complex conjugate of Z_s
88. A unit magnetic pole may be defined as that pole which when placed in vacuum at a distance one metre from a similar and equal pole repels it with a force of

- (A) $\frac{1}{4\pi}$ newton
 (B) $\frac{\mu_0}{4\pi}$ newton
 (C) $\frac{\pi}{4\mu_0}$ newton
 (D) $\frac{1}{4\pi\mu_0}$ newton

89. The relation among electric field intensity E , voltage applied V and distance d between the plates of a parallel-plate condenser is

- (A) $E = \frac{V}{d}$
 (B) $E = V \times d$
 (C) $E = \frac{V}{d^2}$
 (D) $E = V \times d^2$

90. The force experienced by a conductor of length L carrying a current of i amp which is lying parallel to a magnetic field B is

- (A) zero
 (B) BiL
 (C) $BiL \sin \theta$
 (D) $BiL \cos \theta$

91. A solid sphere made of insulating material has radius R and has a total charge Q distributed uniformly in its volume. What is the magnitude of the electric field intensity, E at a distance r ($0 < r < R$) inside the sphere?

- (A) $\frac{1}{4\pi\epsilon_0} \frac{Qr}{R^3}$ (B) $\frac{3}{4\pi\epsilon_0} \frac{Qr}{R^3}$
 (C) $\frac{1}{4\pi\epsilon_0} \frac{Qr}{r^3}$ (D) $\frac{1}{4\pi\epsilon_0} \frac{QR}{r^3}$

92. Which of the following equations is correct?

- (A) $a_x \times a_x = |a_x|^2$
 (B) $(a_x \times a_y) + (a_y \times a_x) = 0$
 (C) $a_x \times (a_y \times a_z) = a_x \times (a_z \times a_y)$
 (D) $a_r \cdot a_\theta + a_\theta \cdot a_r = 0$

93. If the electric field established by three point charges Q , $2Q$ and $3Q$ exerts a force $3\vec{F}$ on $3Q$ and $2\vec{F}$ on $2Q$, then what is the force exerted on the point charge Q ?

- (A) \vec{F}
 (B) $-\vec{F}$
 (C) $5\vec{F}$
 (D) $-5\vec{F}$

94. The vector

$$F = (2x + 3ay)i + (2y + 3bx)j + (2x + cz)k$$

is solenoidal if the value of c is

- (A) -2
 (B) -4
 (C) -6
 (D) -8

95. How much current must flow in a loop of radius 1 m to produce a magnetic field of 1 mA/m?

- (A) 1.0 mA
- (B) 1.5 mA
- (C) 2.0 mA
- (D) 2.5 mA

96. If the magnetic field intensity is

$$\vec{H} = 3\bar{a}_x + 7y\bar{a}_y + 2x\bar{a}_z \text{ A/m}$$

what is the current density \vec{j} in A/m²?

- (A) $-2\bar{a}_y$
- (B) $-7\bar{a}_z$
- (C) $3\bar{a}_x$
- (D) $12\bar{a}_y$

97. Calculate the reluctance of a magnetic coil which is wound uniformly on an iron core provided that the relative permeability of the iron core is 1400. Also, the length of the magnetic circuit is 70 cm and the cross-sectional area of the core is 5 cm².

- (A) 3.6×10^5 AT/Wb
- (B) 7.9×10^5 AT/Wb
- (C) 7.9×10^8 AT/Wb
- (D) 4.6×10^8 AT/Wb

98. If the Laplace transform of a signal $y(t)$ is

$$Y(s) = \frac{1}{s(s-1)}$$

then its final value is

- (A) -1
- (B) 0
- (C) 1
- (D) unbounded

99. The area under the curve

$$\int_{-\infty}^{\infty} \delta(t) dt$$

is

- (A) infinity
- (B) unity
- (C) zero
- (D) undefined

100. $u(t)$ represents the unit step function. The Laplace transform of $u(t - \tau)$ is

- (A) $\frac{1}{s\tau}$
- (B) $\frac{e^{-s\tau}}{s}$
- (C) $\frac{1}{s - \tau}$
- (D) $e^{-s\tau}$

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