UNIT-VI

ELECTRICAL ENGINEERING

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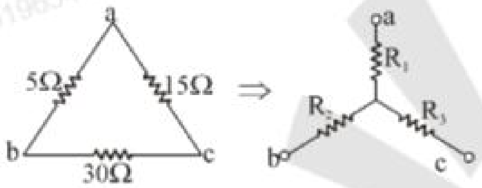
NOTES

CHAPTER 1

BASICS OF CIRCUIT AND CIRCUIT LAW

OBJECTIVE QUESTIONS

1. A delta connected network with its Y-equivalent is shown in figure. The resistances R_1, R_2 and R_3 (in ohms) are respectively



(a) 1.5, 3 and 9 (b) 3, 9 and 1.5

(c) 9, 3 and 1.5 (d) 3, 1.5 and 9

2. A network contains linear resistors and ideal voltage sources. If values of all the resistors are doubled then the voltage across each resistor is

(a) Halved

(b) Doubled

(c) Increased by four times

(d) Not changed

3. A 3 H inductor has 2000 turns. How many turns must be added to increase the inductance to 5H?

(a) 1000 turns (b) 2500 turns

(c) 2582 turns (d) 582 turns

4. An electric circuit with 10 branches and 7 nodes will have

(a) 3 loop equations

(b) 4 loop equations

(c) 7 loop equations

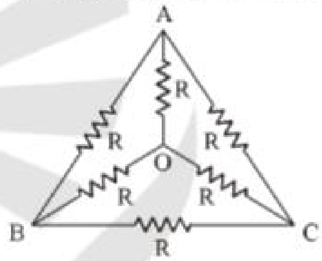
(d) 10 loop equations

5. The response of network is $i(t) = Kt\, e^{-\alpha t}$ for $t \geq 0$ where α is real positive. The value of 't' at which the i(t) will become maximum, is

(a) α (b) 2α

(c) $\frac{1}{\alpha}$ (d) α^2

6. The effective resistance between the terminals A and B in the circuit shown in the figure is



(a) R (b) R–1

(c) $\frac{R}{2}$ (d) $\frac{6}{11}R$

7. If the length of a wire of resistance R is uniformly stretched to n times its original value, its new resistance is

(a) nR (b) $\frac{R}{n}$

(c) n^2R (d) $\frac{R}{n^2}$

8. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the mains. Then

(a) The bulbs together consume 100 W

(b) The bulbs together consume 50 W

(c) The 60 W bulb glows brighter

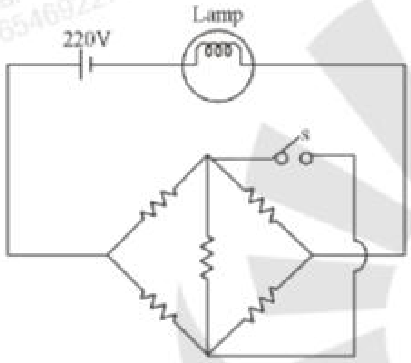
(d) The 40 W bulb glows brighter

9. Twelve 1 Ω resistances are used as edges to form a cube. The resistance between the two diagonally opposite corners of the cube is

(a) $\frac{5}{6}\Omega$ (b) 1 Ω

(c) $\frac{6}{5}\Omega$ (d) $\frac{3}{2}\Omega$

10. All resistance in the given circuit are at R Ω each. The switch is initially open. What happens to the lamp's intensity when the switch is closed?



(a) Increases

(b) Decreases

(c) Remains the same

(d) Depends on the value of R

11. If each branch of a delta circuit has impedance $\sqrt{3}\,Z$, then each branch of equivalent star circuit has impedance would be

(a) $\frac{Z}{\sqrt{3}}$ (b) Z

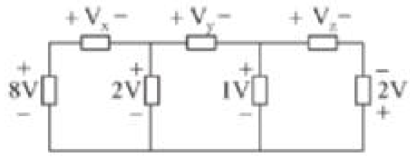
(c) $2\sqrt{3}\,Z$ (d) $\frac{Z}{3}$

12. Two resistances are connected in parallel and each dissipates 40 W. The total power supplied by the source is equals to

(a) 80 W (b) 40 W

(c) 160 W (d) 20 W

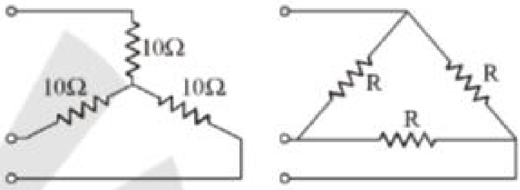
13. The value of V_x, V_y and V_z in figure shown are



(a) −6, 3, −3 (b) −6, −3, 1

(c) 6, 3, 3 (d) 6, 1, 3

14. Star connected load is shown in the figure. The equivalent delta connection has a value of R in Ω is



(a) 10 (b) 30

(c) $\frac{10}{3}$ (d) $\frac{20}{3}$

15. A lamp rated at 10 watt, 50 volts is proposed to be used in 110 volts, system. The wattage and resistance of the resistor to be connected in series with the lamp should be

(a) 15 W, 350 Ω (b) 10 W, 250 Ω

(c) 12 W, 300 Ω (d) 15 W, 250 Ω

16. In a balanced delta connected resistive load when one resistor is open-circuited, then the power drawn by the load would be

(a) Is reduced by $\frac{1}{3}$ (b) Is increased by $\frac{1}{3}$

(c) Remains same (d) Is reduced by $\frac{1}{2}$

17. A cylindrical block of certain material has a resistance R as measured between its circular faces. To half the resistance, all the dimensions of the block must be

(a) Doubled

(b) Halved

(c) Decreased by $\sqrt{2\pi}$

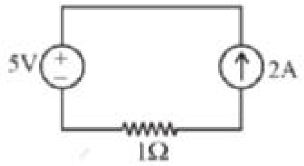
(d) Increased by $\sqrt{2\pi}$

18. The time rate of change of a current passed through a 1mH inductor is 2 mA/s. This means that the voltage across the inductor is.

(a) 0.5×10^{-6} V (b) 0.5 V

(c) 2×10^{-6} V (d) 2 V

19. For the circuit shown in figure



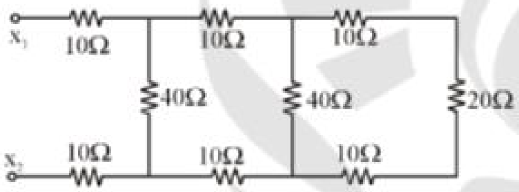
(a) The current depends on the resistor

(b) The Voltage across the current source depends on the resistor.

(c) The current depends on the voltage source

(d) If the resistor were zero, the current would tend to infinity.

20. The approximate equivalent resistance at the points x_1 and x_2 in the circuit shown below



(a) 60 Ω (b) 40 Ω

(c) 80 Ω (d) 20 Ω

21. Two identical resistive loads consumes W watts each when connected in parallel across an ideal current source of I amperes. If, instead, they were connected in series with the same source, their total consumption

(a) Would half

(b) Would double

(c) Would remain the same

(d) Would increase by a factor of 4

22. A house served by a 220V supply light and is protected by a 9 Ampere fuse. The maximum number of 60W bulbs in parallel that can be turned on is

(a) 11 (b) 33

(c) 22 (d) 44

23. The secondary coil of an ideal 2:1 transformer has a 1F capacitor connected across its terminals. The referred impedance on the primary side is of an element

(a) L = 4H (b) C = 0.25 F

(c) L = 0.25 H (d) C = 4F

24. A parallel combination of N resistances is connected an ideal current source of I Amperes. The expression of the current in the k^{th} resistor R_k is

(a) $\left(\frac{R_k}{R_1+R_2+...+R_N}\right)I$ (b) $\left(\frac{\frac{1}{R_k}}{\frac{1}{R_1}+\frac{1}{R_2}+...+\frac{1}{R_N}}\right)I$

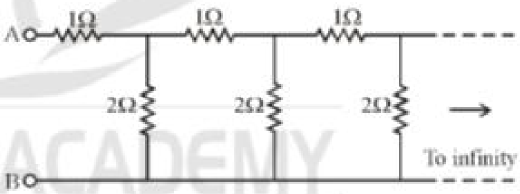
(c) $\left(\frac{R_k}{\frac{1}{R_1}+\frac{1}{R_2}+...+\frac{1}{R_n}}\right)I$ (d) $\left(\frac{\frac{1}{R_k}}{R_1+R_2+...+R_N}\right)I$

25. The resistance of a parallel circuit consisting of two resistors is 12Ω. One of the resistance wires breaks and the effective resistance becomes 18Ω. The resistance of the broken wire is

(a) 48 Ω (b) 18 Ω

(c) 36 Ω (d) 24 Ω

26. The approximate equivalent resistance between terminals A and B for the following infinite ladder network comprising of 1 Ω and 2 Ω resistors is



(a) 1 Ω (b) 2 Ω

(c) 4 Ω (d) 0.5 Ω

27. A practical current source is usually represented by

(a) A resistance in series with an ideal current source

(b) A resistance in parallel with an ideal current source

(c) A resistance in parallel with an ideal voltage source

(d) None of the above

28. Two bulbs marked 200 watt, 250 volts and 100 watt, 250 volts are joined in series to 250 volts supply. Power consumed in circuits is

(a) 33 Watt (b) 67 Watt
(c) 100 Watt (d) 300 Watt

29. Two resistance R_1 and R_2 give combined resistance of 4.5 ohms when in series and 1 ohm when in parallel. The resistances R_1 and R_2 are respectively.

(a) 3 ohms and 6 ohms
(b) 3 ohms and 9 ohms
(c) 1.5 ohms and 3 ohms
(d) 1.5 ohms and 0.5 ohms

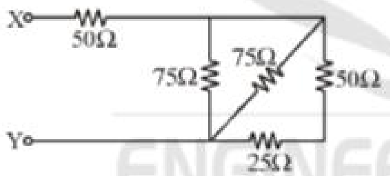
30. Which of the following bulbs will have the least resistance?

(a) 220V, 60W (b) 220V, 100W
(c) 115V, 60W (d) 115V, 100W

31. A resistance of 5 ohms is further drawn so that its length becomes double. Its resistance will now be.

(a) 5 ohms (b) 7.5 ohms
(c) 10 ohms (d) 20 ohms

32. Equivalent resistance between X and Y is



(a) 75 Ω (b) 50 Ω
(c) 275 Ω (d) None of above

33. Three equal resistors, connected in series across a source of emf, dissipated 10W of power. What would be the power dissipated in the same resistor when they are connected in parallel across the same source?

(a) 10W (b) 30W
(c) 90W (d) 270W

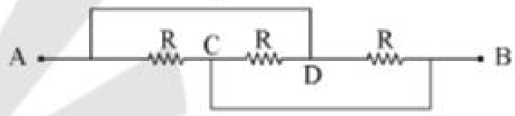
34. A 10Ω resistor is connected in parallel with a 15Ω resistor and the combination in series with a 12Ω resistor. The equivalent resistance of the circuit is:

(a) 37Ω (b) 27Ω
(c) 18Ω (d) None of these

35. The energy used by a 1.5kW heater in 5 minutes is:

(a) 450 000 J (b) 450 J
(c) 7500 J (d) None of these

36. Three equal resistors each equal to R ohm are connected as shown in fig. The equivalent resistance between points A and B is:



(a) R (b) 3R
(c) R/3 (d) 2R/3

37. Two resisters R_1 and R_2 give combined resistance of 6 ohm when in series and 0.83 ohm when in parallel. The resistances R_1 and R_2 are respectively

(a) 3 ohm and 3 ohm
(b) 4 ohm and 2 ohm
(c) 5 ohm and 1 ohm
(d) 4.5 ohm and 1.5 ohm

38. A wire having resistance R_1 is stretched to double its length. The new resistance R_2 is :

(a) R_1 (b) $2R_1$
(c) $4R_1$ (d) $\frac{R_1}{2}$

39. How many coulombs of charge move through a filament of a light bulb in 1.3 s If there is 8 A of current through the filament?

(a) 9.3 (b) 10.4
(c) 6.15 (d) None of these

40. What is the current, in amperes, when 0.95 coulombs pass a point in 5 s?

(a) 1.00 (b) 0.19
(c) 4.75 (d) None of these

41. It was found that the current was 60 mA when a circuit with a particular resistance is connected to a 20 V battery. The current has dropped to 30 mA after sometime. How much has the voltage changed?

(a) 10V (b) 20V

(c) 0V (d) None of these

42. What is the power consumed by the circuit when a bulb of 60 watts and another of 120 watts are joined in a series?

(a) 180 W (b) 40W

(c) 120 W (d) None of these

43. What is the resistance of a 440 cm long wire of 0.28 cm diameter, with specific resistance 0.56 ohm-cm?

(a) 900 Ω (b) 90 Ω

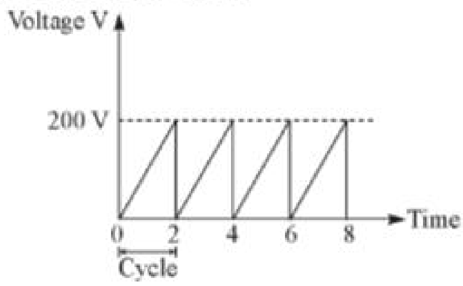
(c) 9 Ω (d) None of these

44. Three resistors of equal resistance connected in series across a power source together dissipate 15 watts of power. What would be the power dissipated when the same resistors are connected in parallel?

(a) 150W (b) 100W

(c) 135W (d) None of these

45. What will be the average value of the sawtooth waveform shown below?



(a) 150 V (b) 100 V

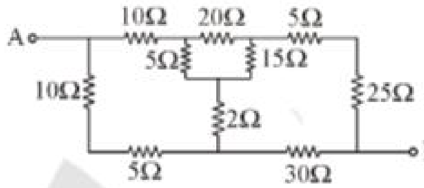
(c) 200 V (d) 250 V

46. It is known that two 2Ω, 2W resistors are connected in parallel. Find the combined resistance and wattage rating.

(a) 2Ω, 4W (b) 1Ω, 4W

(c) 1Ω, 2W (d) 2Ω, 2W

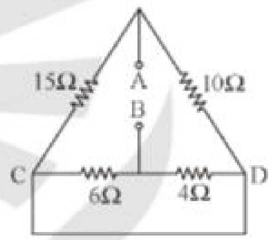
47. Consider the following circuit and determine the equivalent resistance between A and B.



(a) 15.76 Ω (b) 1.63 Ω

(c) 23.52 Ω (d) 2.04 Ω

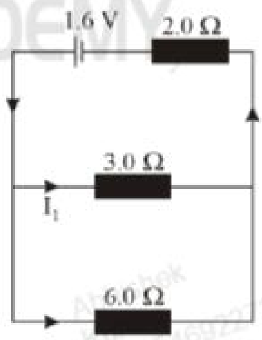
48. In the following circuit, determine the equivalent resistance between points A and B.



(a) 8.4 Ω (b) 4 Ω

(c) 2.5 Ω (d) 6.8 Ω

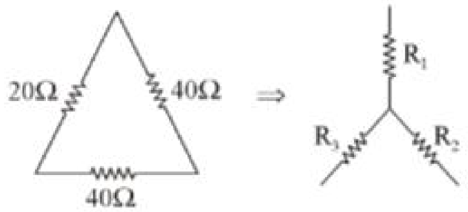
49. Consider the following given circuit and find the value of total current drawn from the cell and the potential difference across the 3Ω resistor respectively.



(a) 0.4 A, 0.8 V (b) 0.85 A, 0.6 V

(c) 0.56 A, 0.8 V (d) 0.9 A, 0.8 V

50. Convert the Delta network into equivalent Star network:



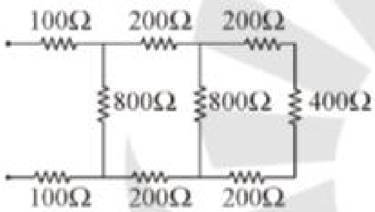
(a) $R_1 = 8\Omega$, $R_2 = 8\Omega$, $R_3 = 8\Omega$

(b) $R_1 = 8\Omega$, $R_2 = 16\Omega$, $R_3 = 16\Omega$

(c) $R_1 = 8\Omega$, $R_2 = 8\Omega$, $R_3 = 16\Omega$

(d) $R_1 = 8\Omega$, $R_2 = 16\Omega$, $R_3 = 8\Omega$

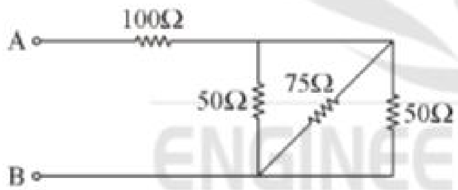
51. The equivalent resistance of the given circuit is:



(a) 200 Ω (b) 400 Ω

(c) 600 Ω (d) 1600 Ω

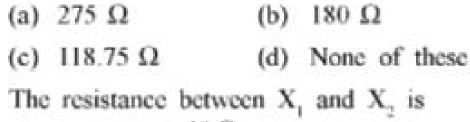
52. In the following figure, the equivalent resistance at terminals A and B will be



(a) 275 Ω (b) 180 Ω

(c) 118.75 Ω (d) None of these

53. The resistance between X_1 and X_2 is



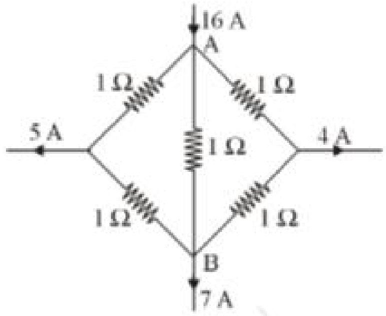
(a) 10 ohm

(b) Greater than 10 ohm

(c) zero

(d) Less than 10 ohm

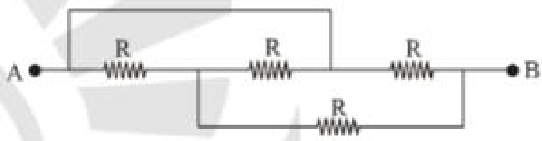
54. In the following dc circuit, determine the current in branch A-B



(a) 6.85 A (b) 5.75 A

(c) 4 A (d) 8.6 A

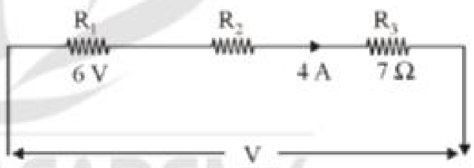
55. Resistance between terminals A and B of the given figure is



(a) 3/5 R (b) 1/5 R

(c) R (d) 2/5 R

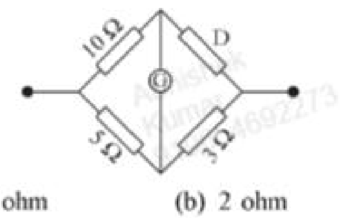
56. Find the value of the resistor R_1 from the given circuit.



(a) 1.5 Ω (b) 1.6 Ω

(c) 1.7 Ω (d) 1.8 Ω

57. The resistance in the element D of the given figure at balance condition is?



(a) 6 ohm (b) 2 ohm

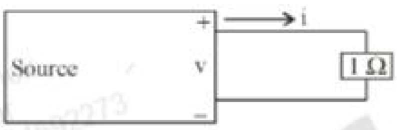
(c) 1 ohm (d) 10 ohm

58. The total power in a series circuit is 10W. there are five equal value resistors in the circuit. How much power does each resistor dissipate ?

(a) 10 W (b) 5 W

(c) 2 W (d) 1 W

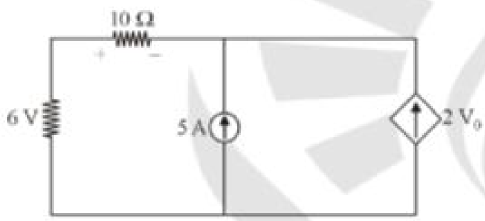
59. As shown in the figure, 1 Ω resistance is connected across a source that has a load line V + i = 100. The current through the resistance



(a) 25 A (b) 50 A

(c) 100 A (d) 200 A

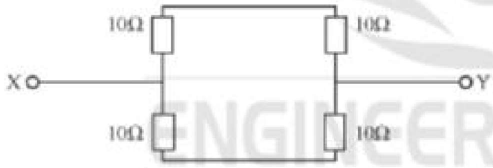
60. The dependent source in the circuit shown is classified as



(a) VCCS (b) VCVS

(c) CCCS (d) CCVS

61. Find out resistance between X and Y in following :



(a) 5 Ω (b) 20 Ω

(c) 10 Ω (d) 40 Ω

62. To determine the value of the net resistance (R) for three parallel resistor R_1, R_2, R_3, we can use the following equation

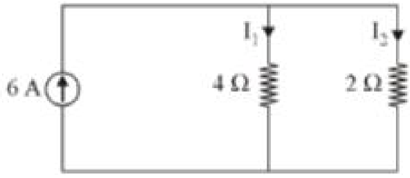
(a) $R = R_1 + R_2 + R_3$

(b) $R = 1/R_1 + 1/R_2 + 1/R_3$

(c) $1/R = 1/R_1 + 1/R_2 + 1/R_3$

(d) $1/R = R_1 + R_2 + R_3$

63. In the circuit shown in Fig. The currents I_1 and I_2, repetitively are



(a) 4A and 8A (b) 2A and 4A

(c) 4A and 2A (d) 6/5A and 12/5

64. Which of the following relation is not correct

(a) $P = \dfrac{V}{R^2}$ (b) $P = VI$

(c) $I = \sqrt{\dfrac{P}{r}}$ (d) $V = \sqrt{PR}$

65. Two bulbs are rated 100 W. Each. If these bulbs are connected in series to the mains supply, 220 V, the total power consumed by both the bulbs would be –

(a) 25 Watts (b) 50 Watts

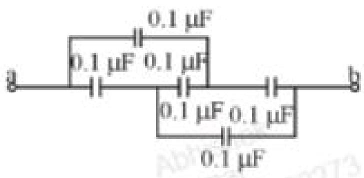
(c) 100 Watts (d) 200 Watts

66. If 2.2 m long conductor has a cross sectional area of 0.025 m^2 and resistance of 5 ohms, find its resistivity :

(a) 0.072 ohm m (b) 0.057 ohm m

(c) 0.58 ohm m (d) 0.67 ohm m

67. The equivalent capacitance between a and b will be



(a) 0.2 μF (b) 0.1 μF

(c) 0.5 μF (d) 0

68. A capacitor stores energy in.......... from

(a) Electric field (b) Electromagnetic

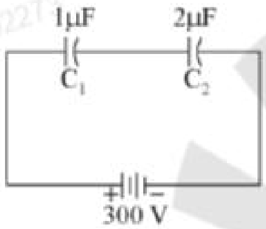
(c) Magnetic field (d) Dielectric dipole

69. Two capacitor C_1 and C_2 have C_1=20μF and C_2= 30μF, are connected in parallel across a 100V source. The net capacitance of the circuit is?

(a) 50 μF (b) 10 μF

(c) 12 μF (d) 60 μF

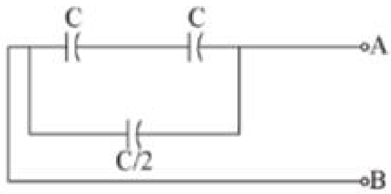
70. In the following figure, the voltage across C_1 will be



(a) 100 V (b) 200 V

(c) 150 V (d) 300 V

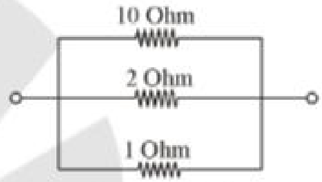
71. In the following circuit, the equivalent capacitance between terminals A and B is



(a) $\frac{C}{2}$ (b) $\frac{2}{3}C$

(c) C (d) 3C

72. The total conductance of the circuit given below



(a) 13 (b) 1.6

(c) 6 (d) 2.5

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ANSWER KEY

1. *Ans. (a)*

$$R_1 = \frac{R_{ac} \times R_{ab}}{R_{ab} + R_{bc} + R_{ca}}$$

$$= \frac{15 \times 5}{15 + 5 + 30}$$

$$R_1 = \frac{75}{50} = 1.5\Omega$$

$$R_2 = \frac{150}{50} = 3\ \Omega$$

and $$R_3 = \frac{450}{50} = 9\Omega$$

2. *Ans. (d)*
3. *Ans. (d)*

$$L \propto N^2$$

$$\therefore \quad N = 2000\sqrt{\frac{5}{3}} = 2582$$

Added number of turns = 582

4. *Ans. (b)*

(b – n + 1) links associated with fundamental loops.

So, $b - n + 1 = 10 - 7 + 1 = 4.$

5. *Ans. (c)*

For maximum i(t)

$$\frac{di(t)}{dt} = 0 = e^{-\alpha t}(1 - \alpha t) = 0$$

$$\Rightarrow \quad t = \frac{1}{\alpha}$$

6. *Ans. (c)*

Using Y-Δ conversion

$$R_{eff} = \frac{\frac{3}{4}R \times \frac{3}{2}R}{\frac{3}{4}R + \frac{3}{2}R} = \frac{R}{2}$$

7. *Ans. (c)*
8. *Ans. (d)*
9. *Ans. (a)*
10. *Ans. (c)*
11. *Ans. (a)*
12. *Ans. (a)*

Total power in parallel circuit

$$= 40 + 40 = 80\ W$$

13. *Ans. (d)*
14. *Ans. (b)*
15. *Ans. (c)*
16. *Ans. (a)*
17. *Ans. (a)*
18. *Ans. (c)*
19. *Ans. (b)*
20. *Ans. (b)*
21. *Ans. (d)*
22. *Ans. (b)*
23. *Ans. (b)*
24. *Ans. (b)*
25. *Ans. (c)*
26. *Ans. (b)*
27. *Ans. (b)*
28. *Ans. (b)*
29. *Ans. (c)*
30. *Ans. (d)*
31. *Ans. (d)*
32. *Ans. (a)*
33. *Ans. (c)*

$$P_{series} = \frac{V^2}{3R} = 10\ W$$

$$= \frac{V^2}{R} = 30\ W$$

$$P_{parallel} = \frac{3V^2}{R}$$

$$= 3 \times 30 = 90W$$

34. *Ans. (c)*

$$R_{eq1} = \frac{10\times15}{10+15} = 6\Omega$$

$$R_{eq} = 12 + 6\Omega = 18\Omega$$

35. *Ans. (a)*

$$1\text{kwh} = 36 \times 10^5 \text{ Joule}$$

$$\text{Total kwh} = 1.5 \times \frac{5}{60}$$

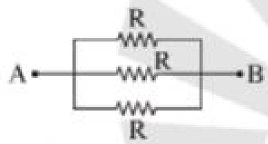
$$= 0.125$$

$$\text{Joule} = 0.125 \times 36 \times 10^5$$

$$\text{Energy} = 450000 \text{ J}$$

36. *Ans. (c)*

Redraw the circuit



$$R_{eq} = R \parallel R \parallel R$$

$$= \frac{R}{3}$$

37. *Ans. (c)*

$$R_{series} = R_1 + R_2$$

$$= 5 + 1 = 6\Omega$$

$$R_{parallel} = \frac{R_1R_2}{R_1+R_2}$$

$$= \frac{5\times1}{5+1} = 0.83$$

38. *Ans. (c)*

$$R = \frac{\rho l}{a};\ R_1 = \rho\frac{(2l)}{(a/2)}$$

$$R_1 = 4R$$

39. *Ans. (b)*

$$\frac{dQ}{dt} = 8A$$

$$dQ = 8 \times 1.3$$

$$dQ = 10.4 \text{ coulombs}$$

40. *Ans. (b)*

$$I = \frac{dQ}{dt}$$

$$I = \frac{0.95}{5} = 0.19 \text{ A}$$

41. *Ans. (a)*

$$R = \frac{V}{I} = \frac{20}{60}\times10^3$$

$$= 333.33\ \Omega$$

$$V = IR$$

$$= 30 \times 10^{-3} \times \frac{20}{60}\times10^3$$

$$= 10 \text{ V}$$

42. *Ans. (b)*

$$P = \frac{P_1\times P_2}{P_1+P_2} = \frac{60\times120}{180}$$

$$= 40 \text{ W}$$

43. *Ans. (d)*

Given $\rho = 0.56$ ohm - m

$l = 440$ cm

$$a = \frac{\pi\times0.28\times0.28\text{ cm}^2}{4}$$

Resistance $R = \dfrac{\rho l}{a}$

$$= \frac{0.56\times440}{\frac{(\pi\times0.28\times0.28)}{4}}$$

$\Rightarrow$ $R = 4000\ \Omega$

44. *Ans. (c)*

Connected in series

$$\Rightarrow \frac{V^2}{3R} = 15$$

$$\frac{V^2}{R} = 45$$

Connected in parallel

$$\frac{3V^2}{R} = 3 \times 45$$

$$= 135 \text{ W}$$

45. *Ans. (b)*

$$\text{Average Value} = \frac{V_m}{2} = \frac{200}{2} = 100\ \text{V}$$

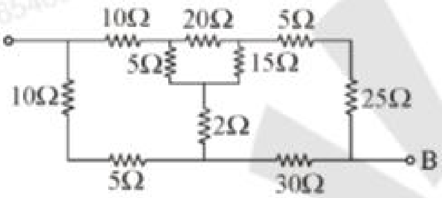
46. *Ans. (b)*

$$R_{eq} = \frac{2\times2}{2+2} = 1\Omega$$

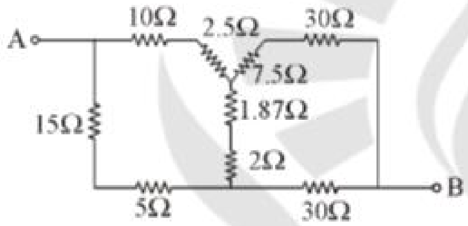
Wattage rating is additive in parallel resistance network.

$\therefore \quad 2W + 2W = 4W$

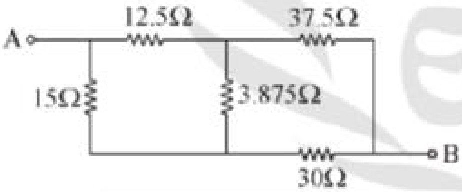
47. *Ans. (b)*



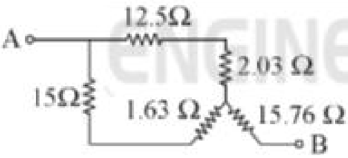
$\Rightarrow$



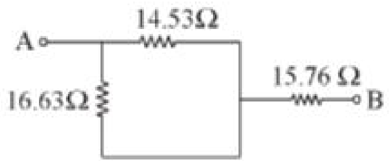
$\Rightarrow$



$\Rightarrow$



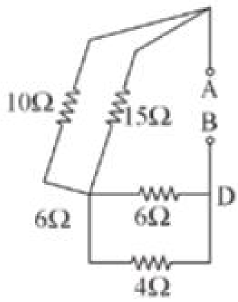
$\Rightarrow$



$$R_{AB} = \frac{14.53\times16.63}{14.53+16.63} + 15.76$$

$$= 23.53\ \Omega$$

48. *Ans. (a)*



$$R_{AB} = 6 + 2.4$$
$$= 8.4\ \Omega$$

49. *Ans. (a)*

$$\text{Total resistance } (R_{eq}) = 3 \parallel 6 + 2$$

$$= \frac{3\times6}{6+3} + 2 = 4\Omega$$

Total current drawn from the cell

$$= \frac{1.6}{4} = 0.4\ \text{A}$$

$$I_1 = \frac{6}{3+6} \times 0.4 = 0.267\ \text{A}$$

$$V_{3\Omega} = 0.267 \times 3 = 0.8\ \text{V}$$

50. *Ans. (d)*

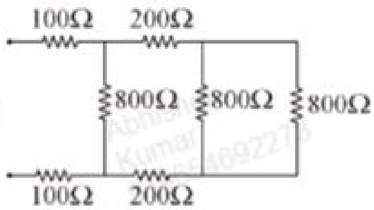
$$R_1 = \frac{20\times40}{20+40+40} = 8\Omega$$

$$R_2 = \frac{40\times40}{20+40+40} = 16\Omega$$

$$R_3 = \frac{20\times40}{20+40+40} = 8\Omega$$

51. *Ans. (c)*

$\Rightarrow$



$$R_{eq} = 600\ \Omega$$

52. ***Ans. (c)***

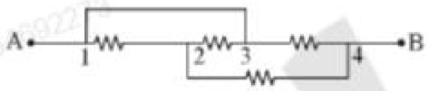
$$R_{eq} = 100 + \left(\frac{1}{50} \| \frac{1}{75} \| \frac{1}{50}\right)$$
$$= 100 + 18.75$$
$$= 118.75\ \Omega$$

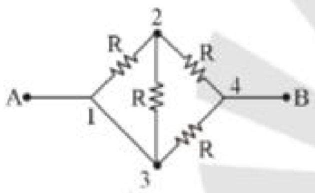
53. ***Ans. (c)***

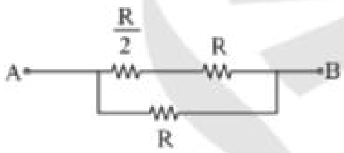
$$R_{eq} = 10 \parallel 0 = 0$$

54. ***Ans. (b)***

55. ***Ans. (a)***







$$R_{AB} = \frac{3}{2}R \| R$$

$$= \frac{\frac{3}{2}R^2}{\frac{5}{2}R} = \frac{3}{5}R$$

56. ***Ans. (a)***

$$V_{eq} = IR_1$$

$$\Rightarrow \quad R_1 = \frac{6}{4} = 1.5\Omega$$

57. ***Ans. (a)***

At Balance

$$10 \times 3 = 5 \times D$$
$$D = 6\ \Omega$$

58. ***Ans. (c)***

Total resistance 5R

$$I^2(5R) = 10\ W$$

$$I = \sqrt{\frac{2}{R}}$$

Power dissipated by each resistor

$$2/R \times R = 2W$$

59. ***Ans. (b)***

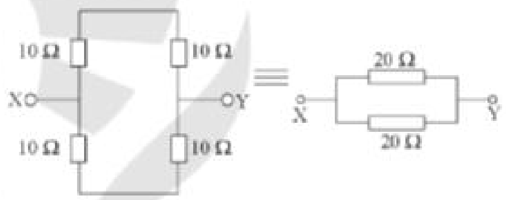
$$V + i = 100 \qquad (V = i{\cdot}R_L = i \times 1)$$

$$\Rightarrow \quad i + i = 100$$

$$\Rightarrow \quad i = \frac{100}{2} = 50 \text{ Amp.}$$

60. ***Ans. (a)***

61. ***Ans. (c)***



E_q Resistance between X & Y = 20 ‖ 20

= 10 Ω

62. ***Ans. (c)***

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

63. ***Ans. (b)***

By current division rule

$$I_1 = \left(\frac{2}{4+2}\right)6 = 2A$$

$$I_2 = 6 - 2 = 4\ A$$

64. ***Ans. (a)***

65. ***Ans. (b)***

$$P_T = \frac{P_1P_2}{P_1 + P_2}$$

$$= \frac{(100)(100)}{200}$$

$$= 50 \text{ watt}$$

66. ***Ans. (b)***

$$R = \frac{\rho l}{A}$$

$$\Rightarrow \quad \rho = \frac{R.A}{l} = \frac{5\times0.025}{2.2}$$

$$= 0.057\ \Omega\text{-m}$$

67. ***Ans. (b)***

68. ***Ans. (a)***

69. ***Ans. (a)***

$$C = C_1 + C_2$$

$$= 20\ \mu F + 30\ \mu F = 50\ \mu F$$

70. ***Ans. (b)***

$$V_{C1} = \frac{\frac{1}{C_1}}{\frac{1}{C_1}+\frac{1}{C_2}}\times 300$$

$$= \frac{10^6}{1\times10^6+0.5\times10^6}\times 300$$

$$= \frac{1}{1.5}\times 300$$

$$= 200 \text{ V}$$

71. ***Ans. (c)***

Two capacitor connected in series

$$C_{eq1} = \frac{C}{2}$$

$$C_T = C_{eq1} + \frac{C}{2}$$

$$= \frac{C}{2} + \frac{C}{2} = C$$

72. ***Ans. (b)***

$$\frac{1}{R_{eq}} = \frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$$

$$G_{eq} = \frac{1}{10}+\frac{1}{2}+1 = \frac{1+5+10}{10}$$

$$= \frac{16}{10} = 1.6 \text{ mho}$$

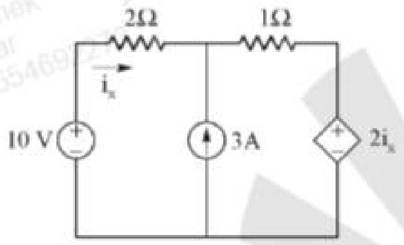
❑❑❑

CHAPTER 2

KVL AND KCL

OBJECTIVE QUESTIONS

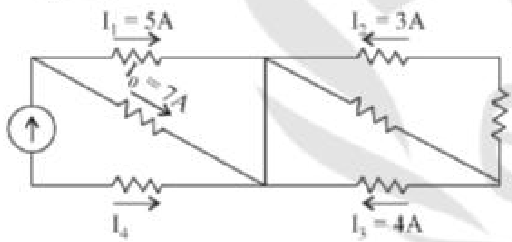
1. In the circuit the value of i_x is



(a) 2 A (b) –0.6 A

(c) 2.6 A (d) 1.4 A

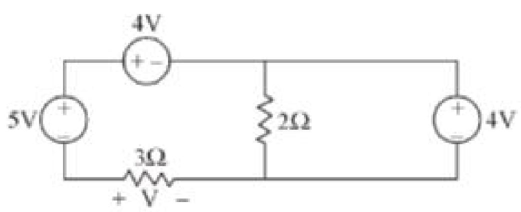
2. The current I_4 in the given circuit of figure, is equal to



(a) 12 A (b) –12 A

(c) 4 A (d) None

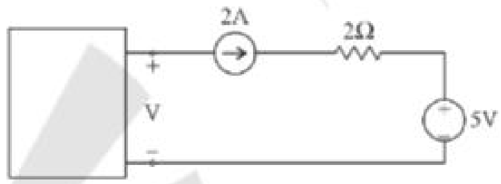
3. The voltage V in given figure is equal to



(a) 3 V (b) – 3V

(c) 5 V (d) None

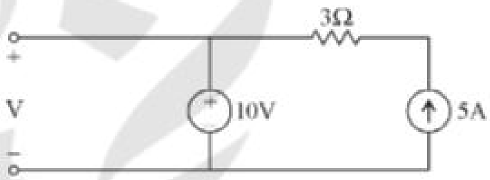
4. The voltage V in figure is equal to



(a) 9 V (b) 5 V

(c) 1 V (d) None

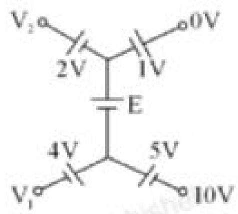
5. The value of voltage V in following figure is



(a) 10 V (b) 15 V

(c) 5 V (d) None

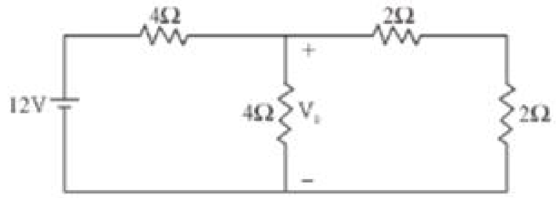
6. In the circuit of given figure, the value of the voltage source E is



(a) – 16 V (b) 4 V

(c) – 6 V (d) 16 V

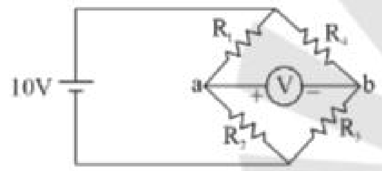
7. The value of voltage V_0 in following figure is



(a) 2 V (b) $\frac{4}{3}$V

(c) 4 V (d) 8 V

8. If $R_1 = R_2 = R_4 = R$ and $R_3 = 1.1$ R in the bridge circuit shown in figure, then the reading in the ideal voltmeter connected between a and b is



(a) 0.238 V (b) 0.138 V

(c) –0.238 V (d) 1 V

9. A 10 V battery with an internal resistance of 1 Ω is connected across a nonlinear load whose V-I characteristic is given by $7I = V^2 + 2V$. The current delivered by the battery is

(a) 0 (b) 10 A

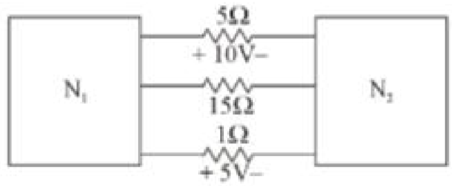
(c) 5 A (d) 8 A

10. Two 2 kΩ, 2W resistors are connected in parallel. Then combined resistance and wattage ratings will be

(a) 4 kΩ, 4W (b) 1 kΩ, 4W

(c) 1 kΩ, 2W (d) 1 kΩ, 1W

11. Two electrical sub-networks N_1 and N_2 are connected through three resistors as shown in figure. The voltages across the 5 Ω resistor and 1Ω resistor are given to be 10 V and 5 V respectively. Then the voltage across the 15 Ω resistor is



(a) –105 V (b) 105 V

(c) –15 V (d) 15 V

12. The nodal method of circuit analysis is based on

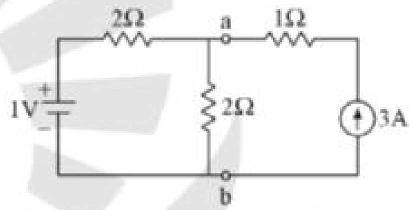
(a) KVL and Ohm's law

(b) KCL and Ohm's law

(c) KCL and KVL

(d) KCL, KVL and Ohm's law

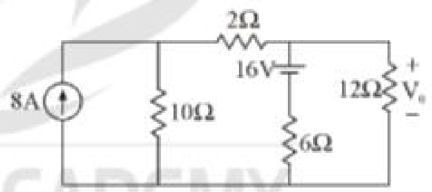
13. The voltage across terminals a and b in given figure is



(a) 0.5 V (b) 3 V

(c) 3.5 V (d) 4 V

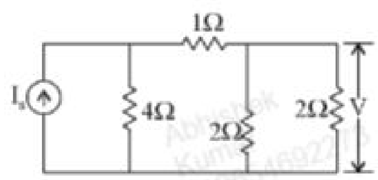
14. The voltage V_0 in given circuit is



(a) 48 V (b) 24 V

(c) 36 V (d) 28 V

15. If V = 4 Volt in figure the value of I_s is



(a) 6 A (b) 2.5 A

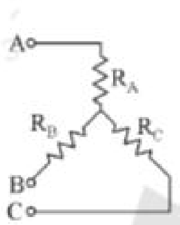
(c) 12 A (d) None of these

16. A network contains only an independent current source and resistors. If the values of all resistors are doubled, the value of the node voltages will

(a) Become half (b) Remain unchanged

(c) Become double (d) None of these

17. Consider the star network shown in figure. The resistance between terminals A and B with C open is 6 Ω, between terminals B and C with A open is 11 Ω and between terminals C and A with B open is 9 Ω then



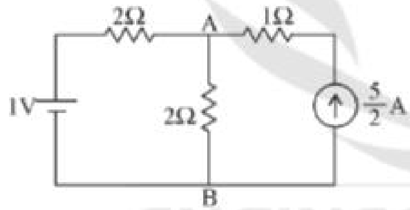
(a) $R_A = 4\Omega$ $R_B = 2\Omega$, $R_C = 5\Omega$

(b) $R_A = 2\Omega$ $R_B = 4\Omega$, $R_C = 7\Omega$

(c) $R_A = 3\Omega$ $R_B = 3\Omega$, $R_C = 4\Omega$

(d) $R_A = 5\Omega$ $R_B = 1\Omega$, $R_C = 10\Omega$

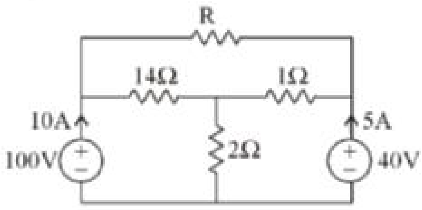
18. The voltage across the terminals A and B in given circuit is



(a) 0.5 V (b) 3 V

(c) 3.5 V (d) 4 V

19. In figure the value of R is



(a) 10 Ω (b) 18 Ω

(c) 24 Ω (d) 12 Ω

20. Kirchoff's current law is valid for

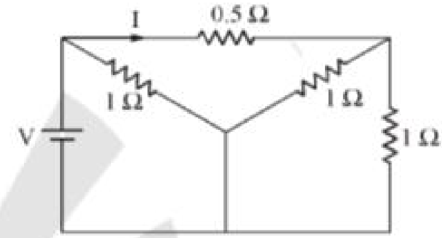
(a) DC circuit only

(b) AC circuit only

(c) Both DC and AC circuits

(d) Sinusoidal source only

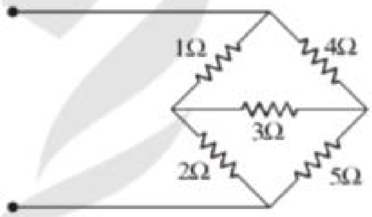
21. In the circuit shown in the figure, if I = 2A, then the value of the battery voltage V will be



(a) 5 V (b) 3 V

(c) 2 V (d) 1 V

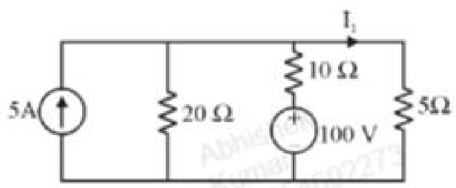
22. The input resistance of the circuit shown is



(a) 1 Ω (b) 3.36 Ω

(c) 2.24 Ω (d) 1.12 Ω

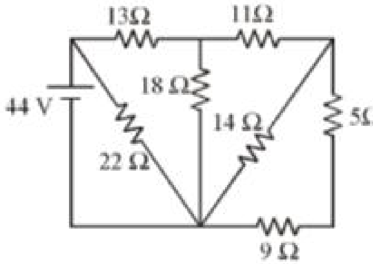
23. The current I_1 through the 5Ω resistor in the network shown in the figure, is



(a) 8.58 A (b) 54 A

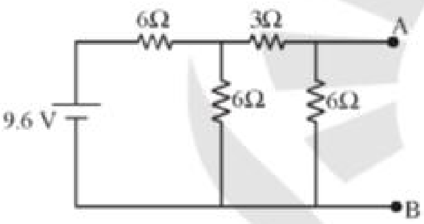
(c) 11.66 A (d) 15 A

24. Referring to the circuit shown below the current in 18Ω resistor is



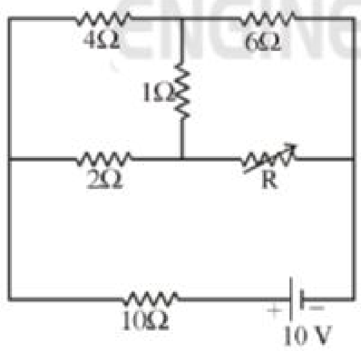
(a) 2 A (b) 1.5 A
(c) 1 A (d) 0.5 A

25. An ideal ammeter is connected between terminals A and B of the network shown below. The current through the ammeter is



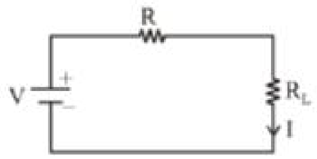
(a) 0.8 A (b) 1.6 A
(c) 0 A (d) 3.2 A

26. For the circuit shown below, the current flowing through 1 Ω resistor is adjusted, to zero by varying the value of R. What is the value of R?



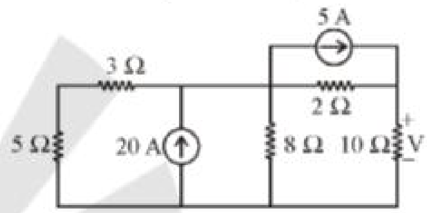
(a) 2 Ω (b) 3 Ω
(c) 4 Ω (d) 6 Ω

27. In the given circuit, if the current I = 3A and 1.5 A for R_L = 0 and 2Ω respectively, then what is the value of I for R_L = 1Ω ?



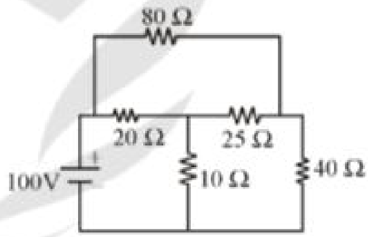
(a) 0.5 A (b) 1.0 A
(c) 2.0 A (d) 3.0 A

28. What is the voltage V in the circuit shown below?



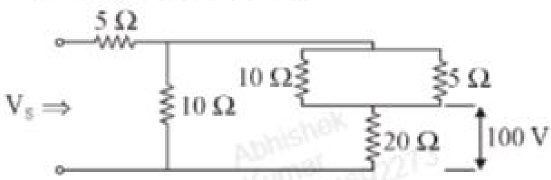
(a) 185 V (b) 115 V
(c) 85 V (d) 56.2 V

29. In the dc network shown in the below figure, the current i in 25 ohm resistor will be



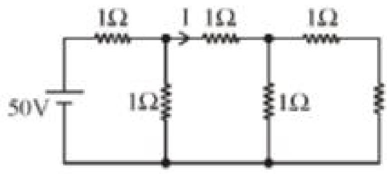
(a) 5 A (b) 4 A
(c) 2.5 A (d) Zero

30. In the circuit given below the voltage across 20 Ω resistor is 100 V. What is the total voltage Vs across the combined circuit?



(a) 100 V (b) 10 V
(c) 20 V (d) 200 V

31. In the given network, the mesh current I and the input impedance seen by the 50V source, respectively are



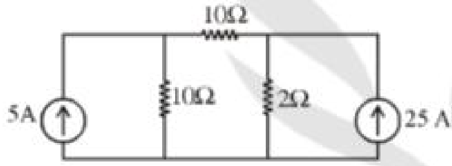
(a) $\frac{125}{13}$ A and $\frac{11}{8}$ Ω

(b) $\frac{150}{13}$ A and $\frac{13}{8}$ Ω

(c) $\frac{150}{13}$ A and $\frac{11}{8}$ Ω

(d) $\frac{125}{13}$ A and $\frac{13}{8}$ Ω

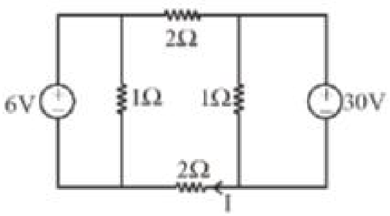
32. For network shown in the given figure, the current in the 2Ω resistor would be



(a) 5A (b) 20A

(c) 25A (d) 30A

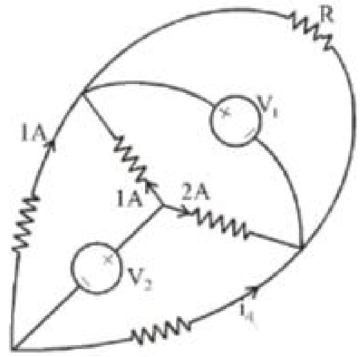
33. What is the value of current in the circuit shown?



(a) 1 A (b) –3A

(c) –6A (d) 9A

34. In the circuit shown in the below figure, the value of current i_4 will be



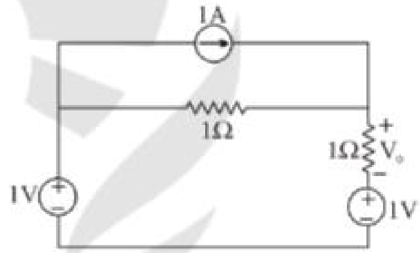
(a) –4A

(b) –2A

(c) Known only if V_1, V_2 and R known

(d) Known only if V_1 and V_2 are known

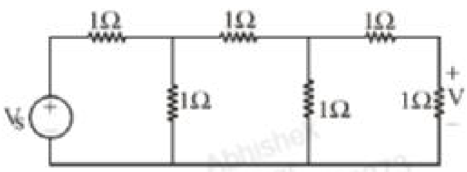
35. The value of V_0 in the figure shown below is



(a) $\frac{1}{2}$ V (b) $-\frac{1}{2}$ V

(c) 0 V (d) $-\frac{3}{2}$ V

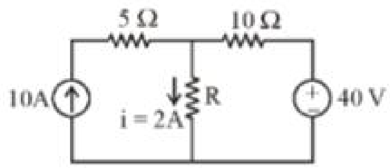
36. In the given circuit the Voltage across last resistor is V. Then V_S is given by



(a) 13 V (b) 8 V

(c) 4 V (d) None of these

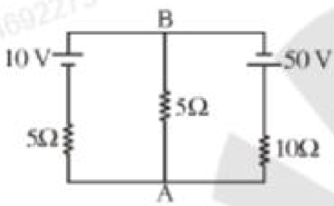
37. In the given circuit the value of R for i = 2A is



(a) 5 Ω (b) 10 Ω

(c) 40 Ω (d) 60 Ω

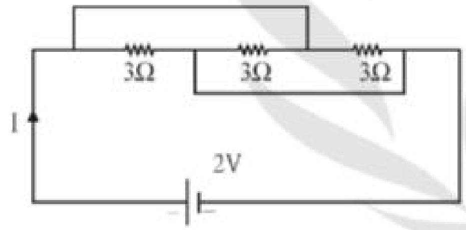
38. For the given circuit, the voltage V_{AB} is



(a) 6 V (b) 10 V

(c) 25 V (d) 40 V

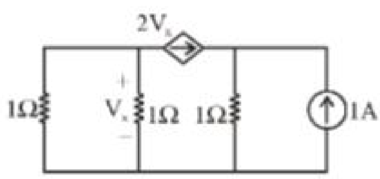
39. For the circuit shown below the current I flowing through the circuit will be



(a) $\frac{1}{2}$ A (b) 1 A

(c) 2 A (d) 4 A

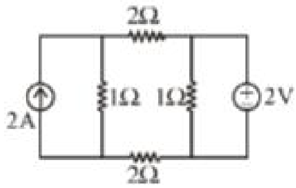
40. In the circuit shown, the power delivered by the dependent source is



(a) 0 W (b) 1 W

(c) 2 W (d) 4 W

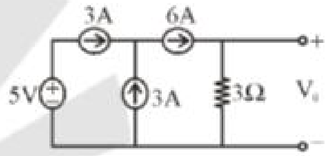
41. In the circuit shown, the power delivered by the current and voltage sources are respectively



(a) 0W, 0W (b) 2W, 2W

(c) 4W, 4W (d) 6W, 6W

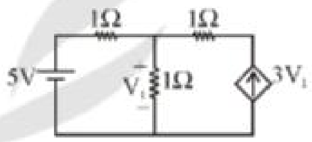
42. In the circuit shown in figure, the output voltage V_o is



(a) 0V (b) 9V

(c) 18 V (d) None

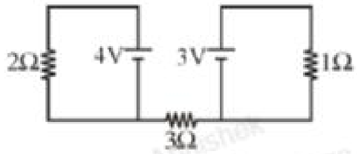
43. Consider the network shown in figure. The dependent source



(a) Delivers 150 W (b) Absorbs 150 W

(c) Delivers 300 W (d) Absorbs 300 W

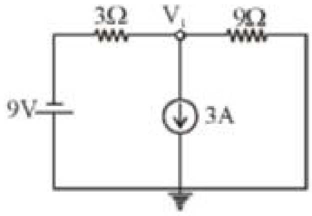
44. The potential difference through the 3Ω resistor as shown in figure is



(a) Zero (b) 1 V

(c) 3.5 V (d) 7 V

45. Consider the network shown in figure

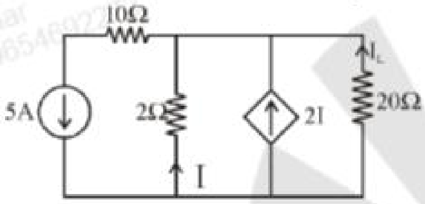


The node voltage V_1 is

(a) −13.5 V (b) −6.75 V

(c) −4.5 V (d) 0 V

46. Consider the network shown in figure

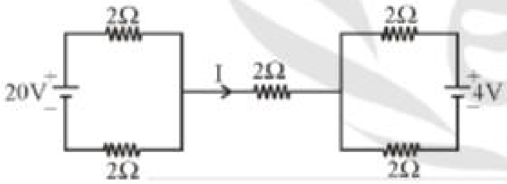


The current I_L is given by

(a) $\frac{50}{31}$A (b) $\frac{5}{11}$A

(c) $\frac{5}{31}$A (d) 0 A

47. Consider the network shown in figure

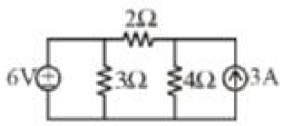


The current I is given by:

(a) −4 A (b) 0 A

(c) 2 A (d) 4 A

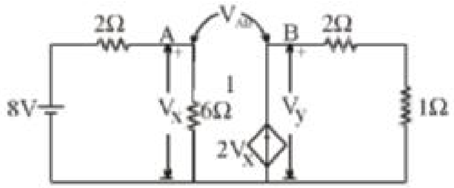
48. Consider the network shown in figure, the total power delivered in the circuit is



(a) 15 W (b) 30 W

(c) 45 W (d) 60 W

49. Consider the circuit shown in figure, the voltages V_{AB} and V_y are respectively



(a) −6V, 36 V (b) 6V, 12V

(c) −30V, 36 V (d) 6V, 0V

50. ***Assertion (A):*** Kirchoff's voltage law states that a closed path in a network, the algebraic sum of all voltages in a single direction is zero.

Reason (R): Law of conservation of charge is the basis of this law.

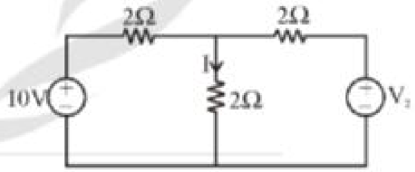
(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true.

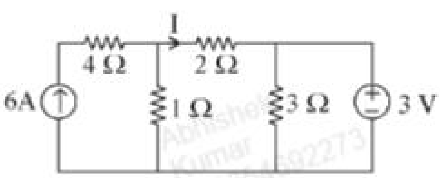
51. For the circuit shown in figure, if the current I = 3A, then the voltage V_2 is



(a) 2.5 V (b) 5 V

(c) 8 V (d) 10 V

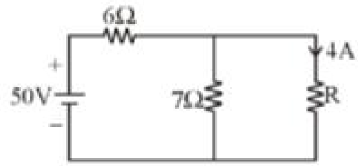
52. For the circuit shown in figure, the current I is



(a) 3 A (b) 1 A

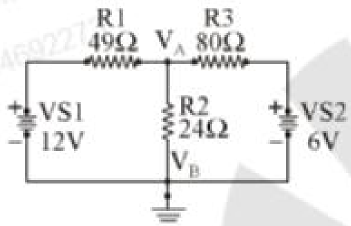
(c) 2 A (d) 0 A

53. The value of resistance R shown in the given figure is



(a) 3.5Ω (b) 2.5 Ω
(c) 1 Ω (d) 4.5 Ω

54. Find the node voltage V_A:



(a) 6 V (b) 12 V
(c) 4.25 V (d) None of these

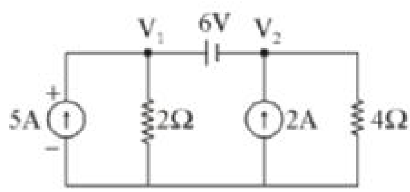
55. The law which states that "At any node or junction in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node" is known as,

(a) Kirchoffs current law
(b) The principle of conservation of electric charge
(c) Both (a) and (b)
(d) None of these

56. Which of the following is used by the branch current method?

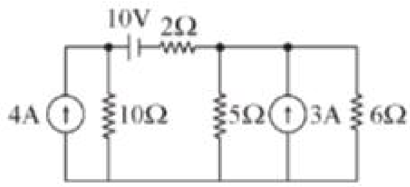
(a) Kirchoff's laws (b) Thevenin's laws
(c) Ohms law (d) None of these

57. Consider the following image and find the current through the 4Ω resistor.



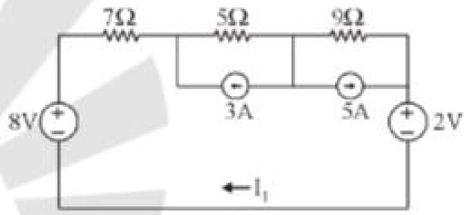
(a) 1.3 A (b) 3.4 A
(c) 2.8 A (d) 4.6 A

58. Consider the following circuit and find the current through the 6Ω resistor.



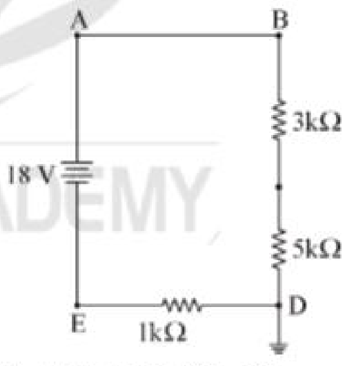
(a) 1.23 A (b) 1.11 A
(c) 2.03 A (d) 0.31 A

59. In the following circuit, determine the current I_1 by using mesh analysis.



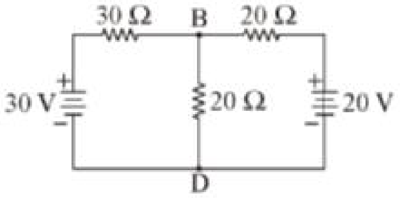
(a) 3.52 A (b) 5.6 A
(c) 6.3 A (d) 1.71 A

60. Determine the value of V_A, V_B, V_C, V_D, V_E. V_A denotes the voltage difference of point A with respect to ground. Similarly, for others.



(a) +16V, +16V, +10V, 0V, −2V
(b) +16V, +10V, +16V, 0V, −2V
(c) +10V, +16V, +10V, 0V, −2V
(d) +16V, +16V, +10V, −4V, −2V

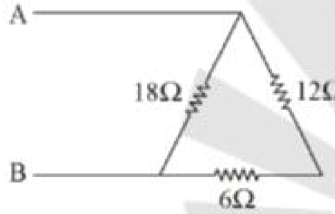
61. In the circuit shown in figure the voltage at the node B with respect to node D is calculated to be 15 V. Then the current in 30 Ω resistor will be:



(a) 2.5 A (b) 2 A

(c) 10 A (d) 0.5 A

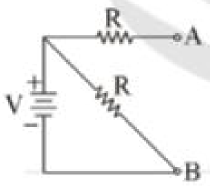
62. If a DC supply of 180V is connected across terminals AB in figure, then current in 6 Ω resistor will be



(a) 6 A (b) 5 A

(c) 12 A (d) 10 A

63. In the circuit shown below, the terminals A and B are short circuited, the current drawn from the battery is



(a) $\frac{V}{R}$ (b) $\frac{2V}{R}$

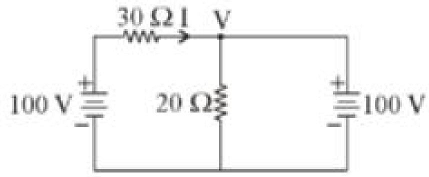
(c) $\frac{V}{2R}$ (d) Zero

64. The output voltage of a battery drops from 100 V with zero load current to 80 V when load current is 2 A. The internal resistance of the battery is

(a) 10 Ω (b) 20 Ω

(c) 40 Ω (d) 50 Ω

65. The current I flowing in the following circuit is



(a) zero (b) 1 A

(c) –1 A (d) $\frac{10}{3}$A

66. A capacitor dissipates _____ energy.

(a) 0% (b) 10% of the stored

(c) 20% of the stored (d) 50% of the stored

67. What will be equivalent resistance and current when a resistor of (1/3)Ω is connected in parallel with a (1/4)Ω resistance connected to 1V dc source?

(a) 1/7 Ω, 7 amp (b) 7 Ω, 7 amp

(c) 1/12 Ω, 12 amp (d) 3/4 Ω, 1 amp

68. Which of the law states that in any closed circuit the current is directly proportional to the voltage, provided the physical conditions of the circuit are kept constant?

(a) Voltage law (b) Current law

(c) Kirchhoff's law (d) Ohm's law

69. A current of 16 amperes divides between two branches in parallel of resistances 8 Ohms and 12 Ohms respectively. The current in each branch is

(a) 6.4 A, 6.9 A (b) 6.4 A, 9.6 A

(c) 4.6 A, 6.9 A (d) 4.6 A, 9.6 A

70. Kirchhoff's current law states that

(a) Net current flow at the junction is positive

(b) Alzebraic sum of the currents meeting at the junction is zero.

(c) No current can leave the junction without some current entering it.

(d) Total sum of currents meeting at the junction is zero.

71. According to Kirchhoff's voltage law, the algebraic sum of all IR drops and e.m.f.s in any closed loop of a network is always

(a) Negative

(b) Positive

(c) Determined by battery e.m.f.s

(d) Zero

72. Kirchhoff's current law is applicable to only

(a) Junction in a network

(b) Closed loops in a network

(c) Electric circuits

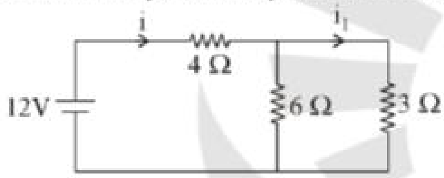
(d) Electronic circuits

73. Kirchhoff's voltage law is related to

(a) Junction currents (b) Battery e.m.f.s

(c) IR drops (d) Both (B) and (C)

74. Calculate the power dissipation in 3Ω resistor



(a) 1.33 W (b) 5.33 W

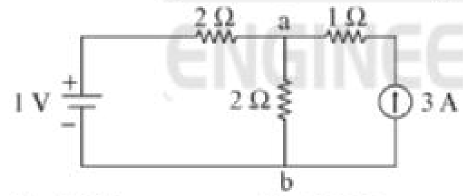
(c) 2.33 W (d) 4.33 W

75. Mesh analysis is applicable only for the network which are ____ in nature.

(a) Polar (b) Planer

(c) Non-polar (d) Non-planer

76. In the circuit given below determine V_{ab}



(a) 2.5 V (c) 3.5 V

(c) 7 V (d) 5 V

77. Three equal resistors of 50 Ω each are connected in parallel across 110 V DC supply. What is the current through each branch if one of the resistors gets shorted ?

(a) 0 A (b) 2.2 A

(c) 4.4 A (d) 6.6 A

78. Mesh analysis is based on –

(a) Kirchhoff's Voltage law

(b) Kirchhoff's Current law

(c) Law of Conservation of Momentum

(d) Law of Conservation of Energy

79. Four resistors of 50 Ω, 50 Ω, 100 Ω and 100 Ω each are connected in parallel across 100V DC supply. What is the current through each branch if both the resistors of 50 Ω burn out?

(a) 1A (b) 6 A

(c) 4 A (d) 2 A

80. A voltage source and two resistor are connected in parallel. Suppose that V_s = 150 V, R_1 = 50 Ω and R_2 = 25 Ω. Then each resistance contain current ?

(a) I_1 = 3 A and i_2 = 6 A

(b) I_1 = 6 A and i_2 = 3 A

(c) I_1 = 3 A and i_2 = 5 A

(d) I_1 = 2 A and i_2 = 3 A

81. A current source and two resistors are connected in series, suppose that i_s = 25 mA, R_1 = 4 Ω and R_2 = 8 Ω. What is the voltage across each resistor ?

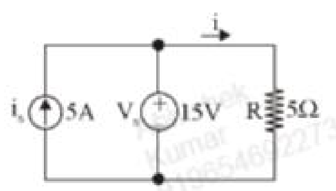
(a) v_1 = 1V and v_2 = 2 V

(b) v_1 = 0.1 V and v_2 = 2 V

(c) v_1 = 0.2 V and v_2 = 0.2 V

(d) v_1 = 0.1 V and v_2 = 0.2 V

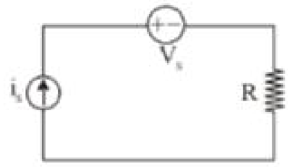
82. A current source and a voltage source are connected in parallel with a resistor as shown below. Suppose that v_s = 15 V, i_s = 5A and R = 5Ω. What is the current in the resistor and the power absorbed by the resistor ?



(a) 5A and 125 W (b) 3A and 45 W

(c) 3A and 15 W (d) 5A and 45 W

83. A current source and a voltage source are connected in series with a resistor as shown below. Suppose that V_s = 10V, i_s = 3A and R = 5Ω. What is the voltage across the resistor and the power absorbed by the resistor ?



(a) 15 V and 45 W (b) 10 V and 20 W

(c) 15 V and 20 W (d) 10 V and 45 W

84. A current source and a voltage source are connected in parallel as shown below. Suppose that V_s = 12 V and i_s = 3A. What is the power supplied by each source ?

(a) The voltage source supplies 36 W and the current source supplies –36 W

(b) The voltage source supplies –36 W and the current source supplies 36 W

(c) The voltage source supplies –16W and current source supplies 36 W

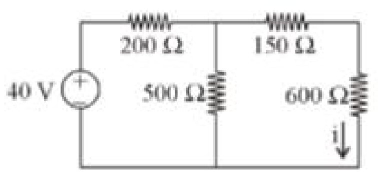
(d) The voltage source supplies 36 W and the current source supplies 36 W

85. A voltage source of 10 V and resistor are connected in series. Specify the resistance R so that both of the following conditions are satisfied : i > 40 mA and the power absorbed by the resistor is < 0.5 W.

(a) 260 Ω (b) 250 Ω

(c) 220 Ω (d) 200 Ω

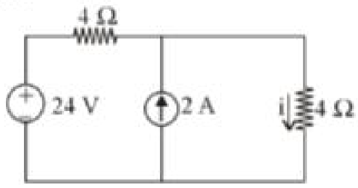
86. Determine the value of the current i for the circuit shown below



(a) 32 mA (b) 25 mA

(c) 20 mA (d) 30 mA

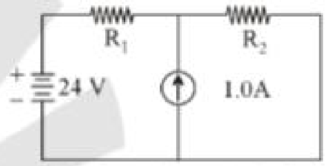
87. Determine the current i in the circuit shown below :



(a) 4 A (b) 2 A

(c) 5 A (d) 3 A

88. The voltage source in the given circuit supplies 24 W of power. The current source supplies 6.0 W. Determine the values of the resistances R_1 and R_2 :



(a) R_1 = 24 Ω and R_2 = 2.5 Ω

(b) R_1 = 18 Ω and R_2 = 2.5 Ω

(c) R_1 = 24 Ω and R_2 = 2.5 Ω

(d) R_1 = 18 Ω and R_2 = 3 Ω

89. Two unequal resistance are connected in parallel, then :

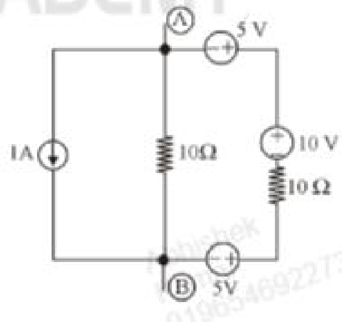
(a) Large current flows through higher resistance

(b) Less current flows through smaller resistance

(c) Equal current flow through both the resistance

(d) Large current flows through smaller resistance

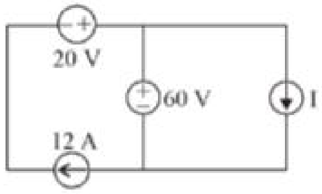
90. An equivalent single current source between 'A' and 'B' in the following figure will be :



(a) 2A, 10 Ω (b) 1A, 5 Ω

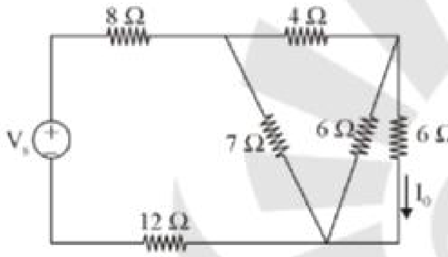
(c) 2A, 5 Ω (d) 1A, 10 Ω

91. In the interconnection of ideal sources shown in the following figure, it is known that the 60 V source is absorbing power. Which of the following can be the value of the current source I ?



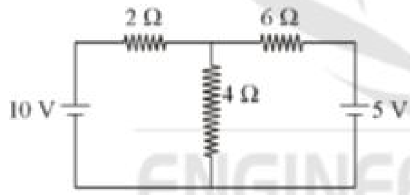
(a) 15 A (b) 18 A
(c) 10 A (d) 13 A

92. For the network shown in the following figure the value of V_s which makes I_0 = 7.5 mA is :



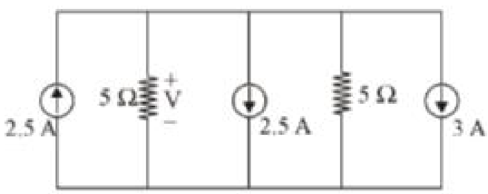
(a) 750 mV (b) 705 mV
(c) 680 mV (d) 695 mV

93. The current through the 4 ohm resistor in a circuit shown below is :



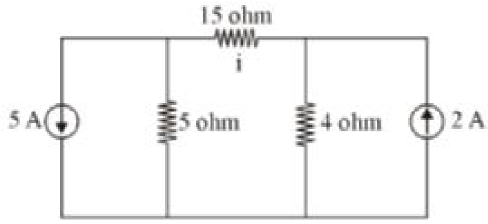
(a) 35/22 A (b) 40/22 A
(c) 39/22 A (d) 5/12 A

94. In the circuit shown, the value of voltage V across 5 Ω is



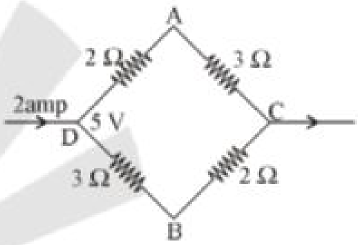
(a) 0 volts (b) 7.5 volts
(c) 40 volts (d) 15 volts

95. Find out the value of i in the given figure.



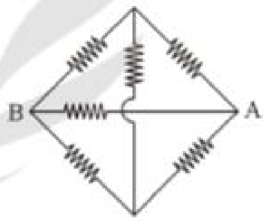
(a) 2.889 A (b) 1.375 A
(c) 5.009 A (d) 7.985 A

96. A current of 2A flows in the circuit shown in figure. The potential difference $V_A - V_B$ is :



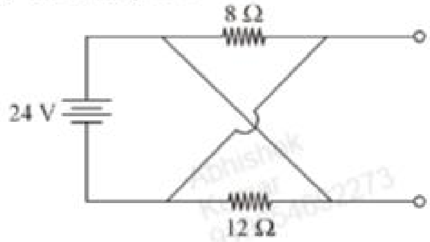
(a) –1V (b) 1V
(c) 2 V (d) 4 V

97. When all the resistance in the given circuit are 1Ω each, the equivalent resistance across the points A and B will be:



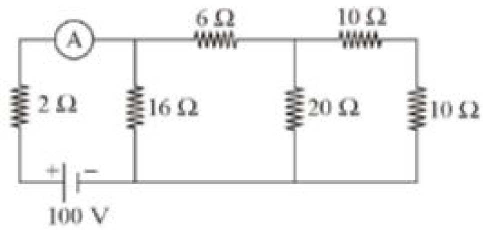
(a) 1 Ω (b) 0.5 Ω
(c) 3 Ω (d) 2 Ω

98. For the given circuit shown, the current supplied by the battery is :



(a) 5 A (b) 3 A
(c) 1.2 A (d) 2 A

99. For the circuit shown in the figure, the ammeter will read.......



(a) 10 A

(b) 20 A

(c) 100 A

(d) 1 A

100. Two resistors of 200 ohm and 100 ohm are connected in parallel to a 100 volt source. Total current taken by the circuit will be –

(a) 0.66 Ampere

(b) 3.0 Ampere

(c) 0.33 Ampere

(d) 1.5 Ampere

101. If a D.C. 240 V is connected across 240 Ω (ohm) resistance, the power of the load is

(a) 240 watts

(b) 1 watt

(c) 10 watts

(d) 480 watts

102. For large networks generally –

(a) The node analysis is preferred

(b) The mesh analysis is preferred

(c) Both node analysis and mesh analysis can be equally preferred

(d) None of these

103. Kirchoff's law is applicable to :

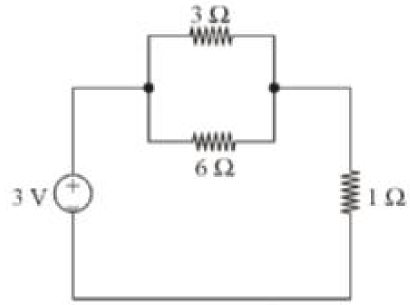
(a) Passive networks only

(b) A.C. Networks only

(c) D.C. Networks only

(d) Both A.C. and D.C. Circuits

104. What is the power supplied by the DC Voltage source in the circuit shown below ?



(a) zero (b) 1 W

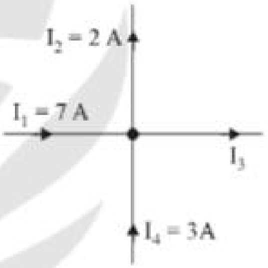
(c) 2.5 W (d) 3 W

105. Kirchhoff's second law is based on law of conservation of

(a) Charge (b) Energy

(c) Momentum (d) Mass

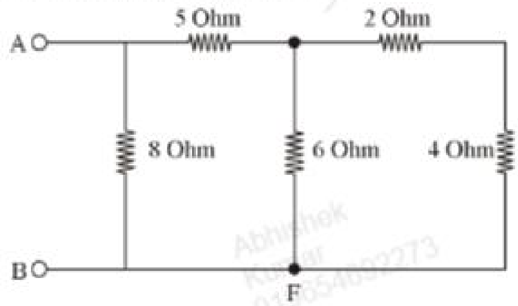
106. Calculate the current I_3 in the circuit



(a) –8 A (b) 8 A

(c) 7 A (d) 12 A

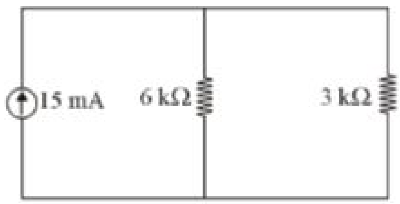
107. A battery of 24 V is applied across terminals AB of the circuit shown in fig. Current in 2 Ohm resister will be



(a) 3 A (b) 6 A

(c) 2.5 A (d) 1.5 A

108. The current in 3 kΩ resistors in figure converting the current source into voltage source will be –



(a) 10 mA (b) 12 mA
(c) 6 mA (d) 5 mA

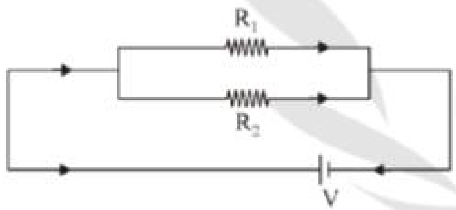
109. A network is said to be reciprocal if :

(a) $Z_{12} = Z_{21}$ (b) $Y_{12} = Y_{21}$
(c) AD-BC = 1 (d) all of these

110. A 12 V battery with an internal resistance 0.5 ohms supply feeds a series circuit containing 20 ohms, 10 ohms, and R. Find the value of R if the current in the circuit is 0.26 A.

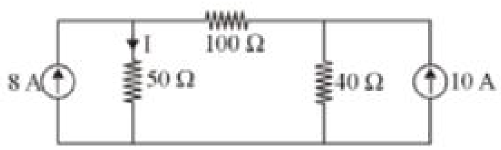
(a) 14.5 ohms (b) 15.5 ohms
(c) 4.5 ohms (d) 5.5 ohms

111. In the given circuit, $R_1 > R_2$, Power dissipation will be



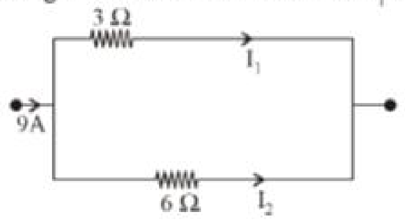
(a) Greater in R_1 (b) Greater in R_2
(c) Equal in both (d) Can't assess

112. In the circuit shown in the given figure, power dissipated in the 50 Ω resistor is



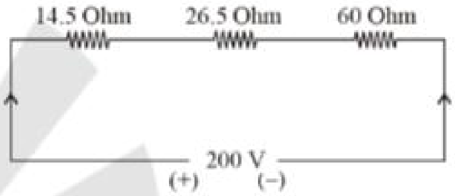
(a) Zero (b) 3.2 kW
(c) 320 W (d) 4 kW

113. In the given below circuit the currents I_1 and I_2 are



(a) 6 A, 3 A (b) 3 A, 6 A
(c) 4.5 A, 4.5 A (d) 5 A, 4 A

114. Voltage drop across 14.5 ohm resistor as shown in figure is :

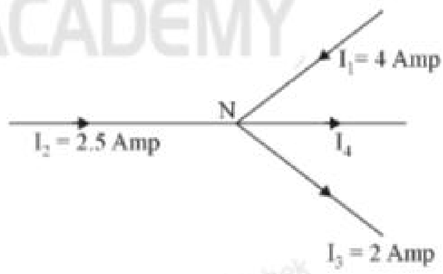


(a) 29 V (b) 30.5 V
(c) 14 V (d) 18 V

115. According to KCL as applied to a junction in a network of conductors

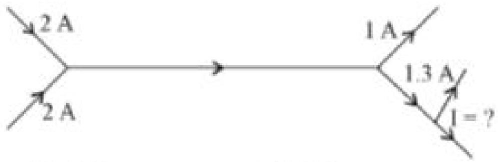
(a) Total sum of currents meeting at the junction is zero
(b) No current can leave the junction without some current entering it
(c) Net current flow at the junction is positive
(d) Algebraic sum of the currents meeting at the junction is zero

116. Current I_4 in the given figure will be



(a) 13 amp (b) 0.5 amp
(c) 4.5 amp (d) 8.5 amp

117. The current 'I' in the electric circuit shown below is ?



(a) 1.7 A (b) 1 A

(c) 2.7 A (d) 3.7 A

118. Kirchoff's first and second laws are respectively based on conservation of :

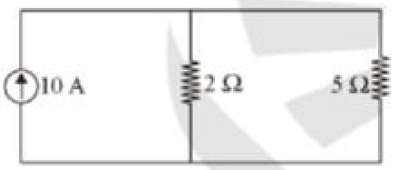
(a) Energy and charge

(b) Charge and energy

(c) Mass and charge

(d) Mass and energy

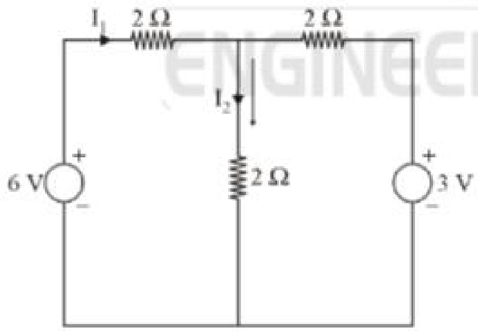
119. In the given circuit find the current through 5 Ω resistor :



(a) 5 A (b) 2.85 A

(c) 3.5 A (d) 7.15 A

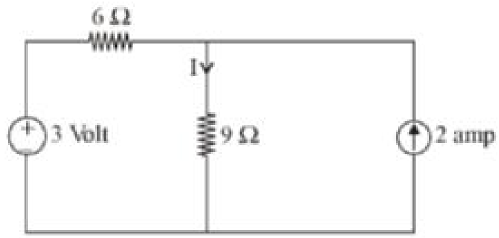
120. In a circuit shown below, if $I_1 = 1.5$ A, then I_2 will be



(a) 0.5 A (b) 1.0 A

(c) 1.5 A (d) 3.0 A

121. Find the value of 'I' in the circuit



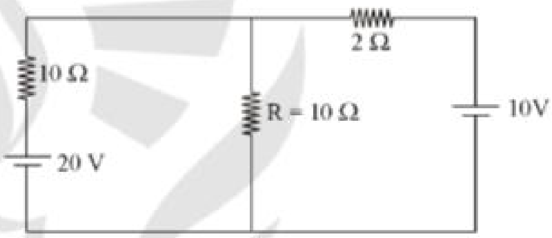
(a) 2 amp

(b) 3 amp

(c) 4 amp

(d) 1 amp

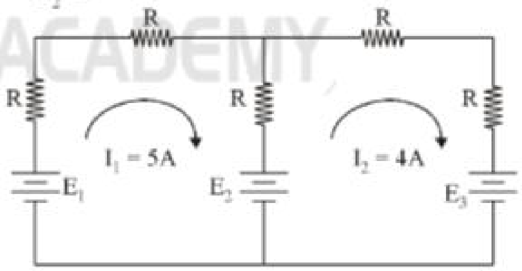
122. The current in the R = 10 Ω resistance in the circuit below is



(a) 0 A (b) 1 A

(c) 2 A (d) 3 A

123. In the given circuit below, the current through E_2 is



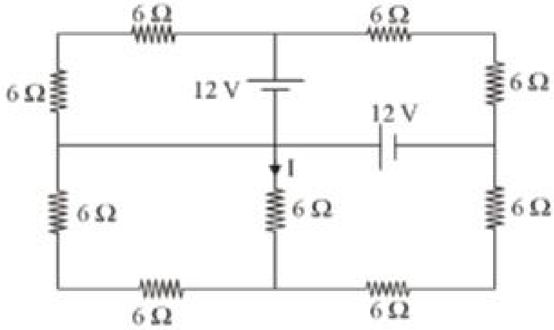
(a) 9 A discharging

(b) 9 A charging

(c) 1 A discharging

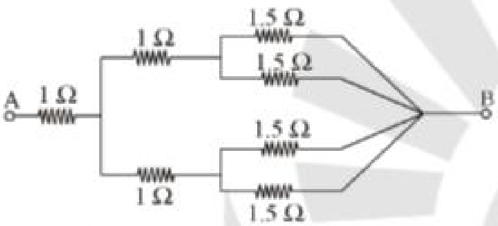
(d) 1 A charging

124. For the circuit of the given figure, the value of current I is



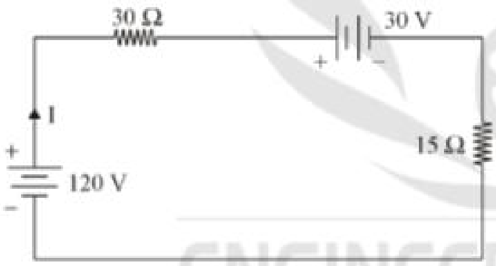
(a) 1.0 A (b) 0.75 A
(c) 0.5 A (d) 0.25 A

125. Equivalent resistance between A & B, in the figure above is



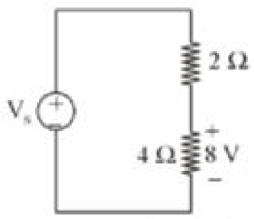
(a) 1.875 Ω (b) 2.875 Ω
(c) 0.53 (d) 2.125 Ω

126. Find power absorbed/delivered by 120 V sources.



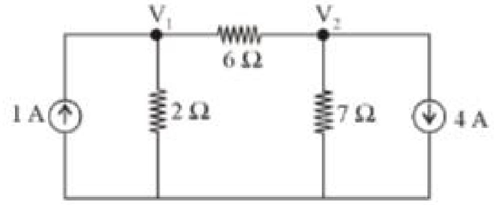
(a) 120 watts (b) 240 watts
(c) 2 watts (d) 1 watt

127. In the circuit, the value V_s is



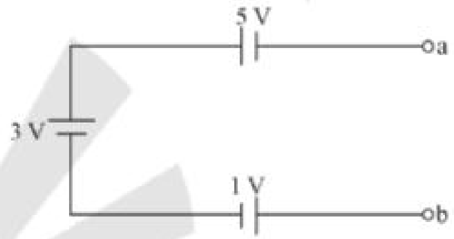
(a) 8 V (b) 10 V
(c) 12 V (d) 16 V

128. In the given figure value of V_1 will be–



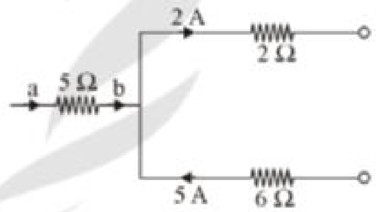
(a) 2 V (b) 4 V
(c) – 14 V (d) –2 V

129. The voltage V_{ab} in the figure will be



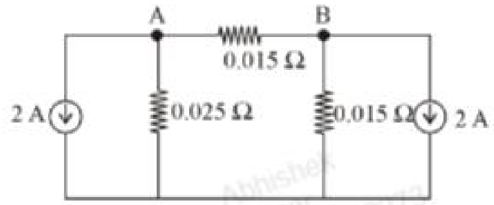
(a) 3 Volts (b) 7 Volts
(c) –3 Volts (d) 0 Volts

130. The voltage V_{ab} in the circuit (which is a part of a larger circuit) will be



(a) 3 Volts (b) –3 Volts
(c) 15 Volts (d) –15 Volts

131. Calculate voltage at point A



(a) –75 V (b) –50 V
(c) 25 V (d) –10 V

132. If the current flowing in the circuit shown is 2A, the value of resistance R will be

(a) 6 Ω (b) 3 Ω
(c) 9 Ω (d) 12 Ω

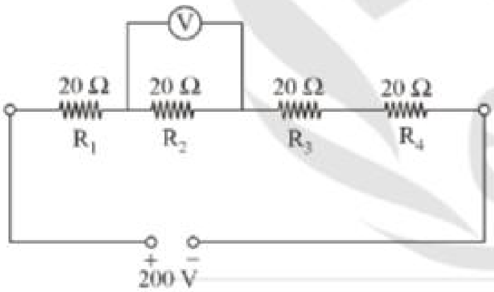
133. Three resistors of 3 ohm, 10 ohm and 15 ohm are connected in parallel in a 30 V circuit. The current will that flow through the 3-ohm resistor is –

(a) 30 A (b) 10 A
(c) 6 A (d) 2 A

134. Which network analysis states that the algebraic sum of voltage on a closed loop is zero ?

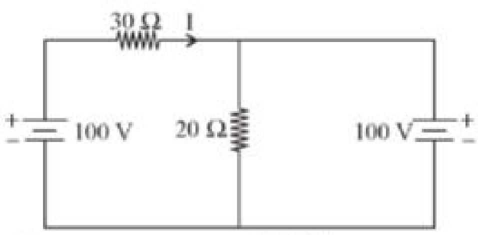
(a) Cramers method
(b) Nodal method
(c) Loop current method
(d) Current sources in loop current method

135. In the following figure, resistor R_2 becomes open circuited, the reading of voltmeter will be



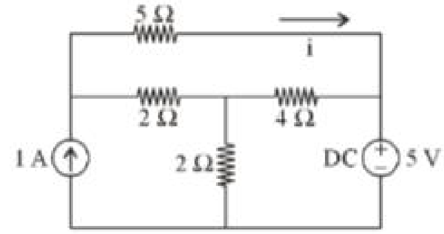
(a) zero (b) 50 V
(c) 150 V (d) 200 V

136. The current I flowing in the following circuit is



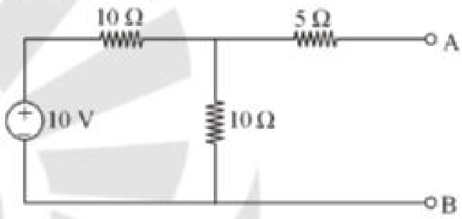
(a) zero (b) 1 A
(c) –1 A (d) $\frac{10}{3}$A

137. In the following given circuit what will be the value of current in the 5 Ω resistor ?



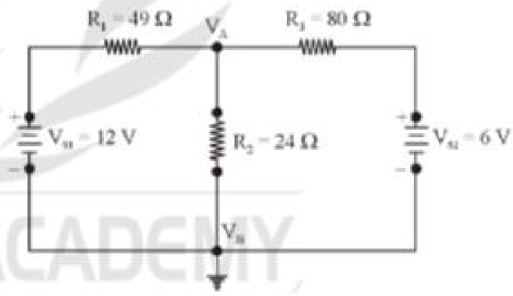
(a) 5A (b) 4 A
(c) 2 A (d) 0 A

138. For the circuit given in the figure, the thevenin's voltage and resistance as seen at AB are represented by :



(a) 5 V, 10 Ω (b) 10 V, 10 Ω
(c) 5 V, 5 Ω (d) 54 V, 15 Ω

139. For the given circuit find the node voltage V_A :



(a) 6 V (b) 12 V
(c) 4.25 V (d) None of these

140. A 35 V DC supply is connected across a resistance of 600 ohm in series with an unknown resistance R. A voltmeter having a resistance of 1.2 kΩ is connected across 600 ohm resistances and reads 5V. The value of resistance R shall be :

(a) 1.2 kΩ (b) 2.4 kΩ
(c) 120 kΩ (d) 400 kΩ

141. Kirchhoff's voltage laws are NOT applicable to circuits with ....

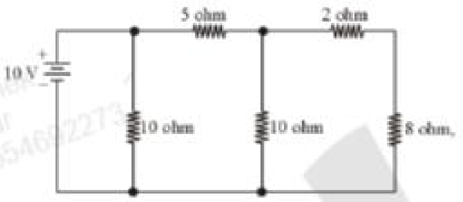
(a) Distributed parameters

(b) Lumped parameters

(c) Passive-elements

(d) Non-linear resistance

142. In the given circuit the current through 8 ohms branch is –



(a) 1 A (b) 0.5 A

(c) 1.5 A (d) None of these

143. If two resistance of 660 Ω are connected in parallel, the total or equivalent resistance is

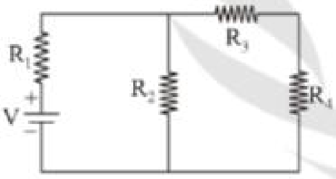
(a) 330 Ω (b) 1320 Ω

(c) 66 Ω (d) None of these

144. For the given circuit calculate voltage drop across R_4. Given V = 12 V.

R_1 = 2 ohm R_2 = 3 ohm

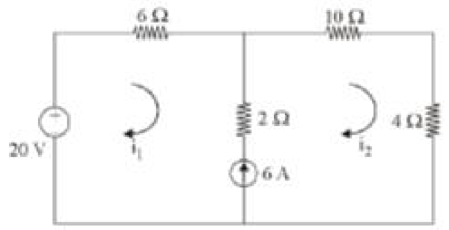
R_3 = 3 ohm R_4 = 3 ohm



(a) 2 V (b) 3 V

(c) 4 V (d) 5 V

145. In the circuit shown which of the following statements is NOT correct ?



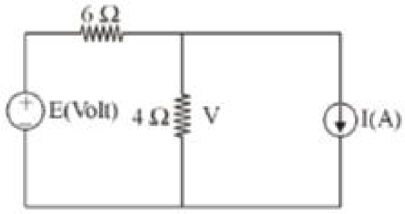
(a) The circuit has a super mesh

(b) $i_2 = i_1 + 6$

(c) $-20 + 6i_1 + 14\, i_2 = 0$

(d) $-20 + 6i_1 + 2(i_1 - i_2) = 0$

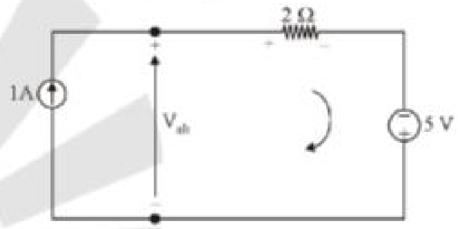
146. In the circuit shown. The voltage across 4Ω resistance 'V' can be expressed as :



(a) 0.4 E – 0.6 I (b) 0.6 E – 0.4 I

(c) 0.4 E – 2.4 I (d) 0.4 E + 2.4 I

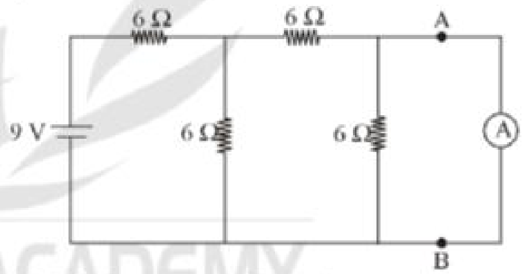
147. Assuming ideal elements in the circuit shown below, the voltage V_{ab} will be



(a) –3V (b) 0V

(c) 3V (d) 5 V

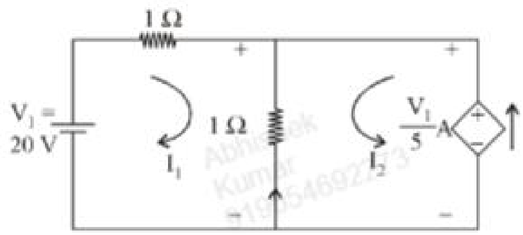
148. An ideal ammeter is connected between terminals A and B. The reading of the ammeter is.



(a) 0.8 A (b) 1 A

(c) 0.5 A (d) 0.6 A

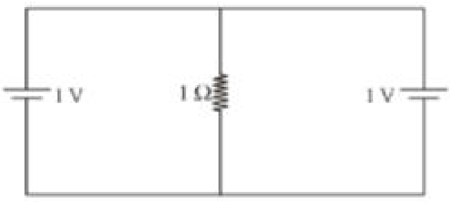
149. In the circuit shown, the dependent source



(a) Delivers 24 W (b) Delivers 48 W

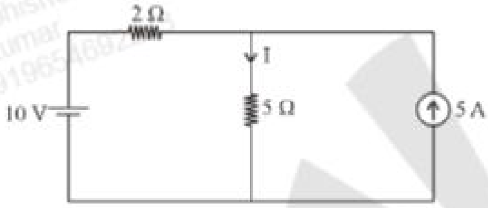
(c) Absorbs 48 W (d) Absorbs 24 W

150. The current in the 1 ohm resistor in the circuit is



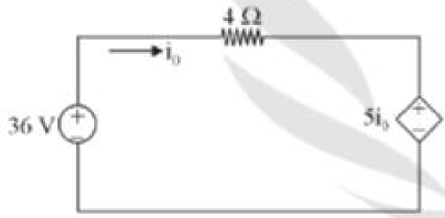
(a) Zero (b) 0.5 A
(c) 2 A (d) 1 A

151. The current I in the circuit is



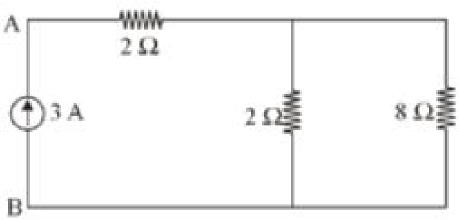
(a) $\frac{10}{7}$ A (b) zero
(c) $\frac{20}{7}$ A (d) $\frac{30}{7}$ A

152. The current in the circuit is



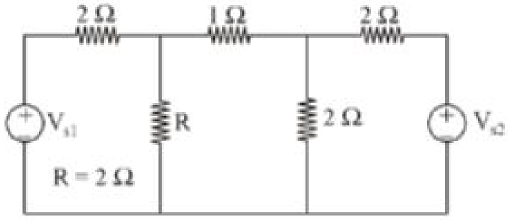
(a) 9 A (b) 4.45 A
(c) 10.25 A (d) 4 A

153. What is voltage V_{AB} across the current source in the following figure ?



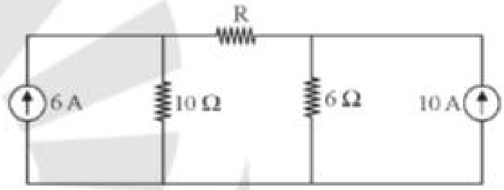
(a) 8/3 V (b) 36 V
(c) 54/5 V (d) 27 V

154. In the circuit shown the power dissipate in resistor R is 8 W, when V_{s1} = 12 V and V_{s2} = 0 V. Find the Power in the same resistor R when V_{s1} = 12 V and V_{s2} = 24 V, in watts.



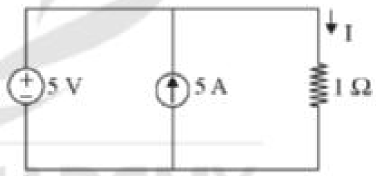
(a) 16 (b) 24
(c) 0 (d) 32

155. In the circuit shown figure the power dissipated in watts, in the resistor R is



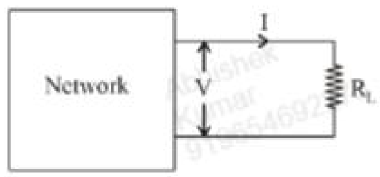
(a) 36 R (b) 0
(c) 100 R (d) 16 R

156. The value of current I flowing in the 1Ω resistor in the circuit shown will be



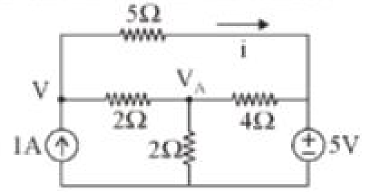
(a) 10 A (b) 6 A
(c) 5 A (d) Zero

157. For network shown in below figure, when I = 0, then V = 20 V and when R = 0, then I = 10 A. If now R = 3 Ω what is the value of the current I?



(a) 6.67 A (b) 6.0 A
(c) 4.0 A (d) 10.0 A

158. In the following given circuit what will be the value of current i in the 5Ω resistor?



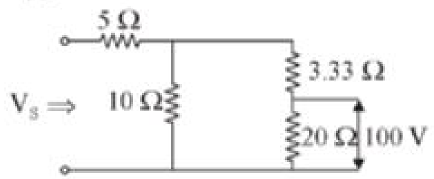
(a) 5A (b) 4A

(c) 2A (d) 0A

❑❑❑

Answer Key

1. *Ans. (d)*
2. *Ans. (b)*
3. *Ans. (a)*
4. *Ans. (d)*
5. *Ans. (a)*
6. *Ans. (a)*
7. *Ans. (c)*
8. *Ans. (c)*
9. *Ans. (c)*
10. *Ans. (b)*
11. *Ans. (a)*
12. *Ans. (b)*
13. *Ans. (c)*
14. *Ans. (d)*
15. *Ans. (a)*
16. *Ans. (c)*
17. *Ans. (b)*
18. *Ans. (b)*
19. *Ans. (d)*
20. *Ans. (c)*
21. *Ans. (c)*
22. *Ans. (c)*
23. *Ans. (a)*
24. *Ans. (c)*
25. *Ans. (a)*
26. *Ans. (b)*
27. *Ans. (c)*
28. *Ans. (d)*
29. *Ans. (d)*
30. *Ans. (d)*



Current in 20Ω resistor

$$= \frac{100}{20} = 5\text{A}$$

$$\text{Total voltage} = 100 + 3.33 \times 5$$
$$= 116.65\ \text{V}$$

Current in 10Ω resistor

$$= \frac{116.65}{10} = 11.665\ \text{A}$$

$$\text{Total current} = 11.665 + 5$$
$$= 16.665\ \text{A}$$

$$\text{Voltage at } 5\Omega = 16.665 \times 5 = 83.325$$

$$\text{Total Voltage } V_s = 116.65 + 83.325 = 200\text{V}$$

31. *Ans. (b)*
32. *Ans. (c)*
33. *Ans. (c)*
34. *Ans. (a)*
35. *Ans. (a)*
36. *Ans. (a)*
37. *Ans. (d)*
38. *Ans. (a)*
39. *Ans. (c)*
40. *Ans. (a)*
41. *Ans. (c)*
42. *Ans. (c)*
43. *Ans. (c)*
44. *Ans. (a)*
45. *Ans. (a)*
46. *Ans. (c)*
47. *Ans. (b)*
48. *Ans. (b)*
49. *Ans. (c)*
50. *Ans. (c)*
51. *Ans. (c)*
52. *Ans. (b)*

$$\frac{V}{1}+\frac{V-3}{2}=6$$

$$2V + V - 3 = 12$$

$$V = 5V$$

$$I=\frac{5-3}{2}=1A$$

53. ***Ans. (a)***

54. ***Ans. (c)***

$$\frac{V_A-12}{49}+\frac{V_A}{24}+\frac{V_A-6}{80}=0$$

$$V_A = 4.25\ V$$

55. ***Ans. (c)***

56. ***Ans. (a)***

57. ***Ans. (a)***

$$\frac{V_1}{2}+\frac{V_2}{4}=5+2$$

$$2V_1 + V_2 = 28 \quad ...(1)$$

$$V_1 - V_2 = 6 \quad ...(2)$$

After solving (1) and (2)

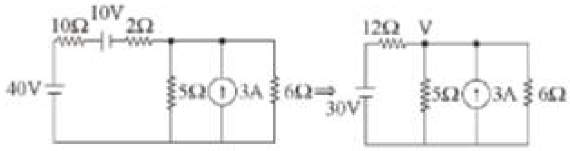
$$V_1=\frac{34V}{3},\ V_2=\frac{16}{3}$$

$$I=\frac{5.333}{4}=5.33\ V$$

$$= 1.33\ A$$

58. ***Ans. (c)***

Redraw the circuit



$$\frac{V-30}{12}+\frac{V}{5}+\frac{V}{6}=3$$

$$V=\frac{330}{27}=12.22\ V$$

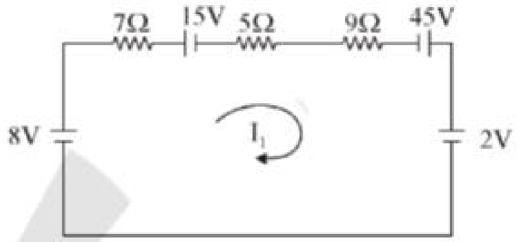
Current through the 6Ω resistor

$$=\frac{V}{6}=\frac{12.22}{6}$$

$$= 2.037A$$

59. ***Ans. (d)***

By using source conversion, redraw the circuit



$$-8+7I_1+15+5I_1+9I_1-45+2 = 0$$

$$21I_1 = 36$$

$$I_1=\frac{36}{21}=1.71\ A$$

60. ***Ans. (a)***

$$I=\frac{18}{3+5+1}=2\ mA$$

$$V_A = 18 - 2 = 16V$$

$$V_A = V_B = 16V$$

$$V_C = 16 - (3 \times 2) = +10V$$

$$V_D = 0\ \text{(Grounded)}$$

$$V_E = -2V$$

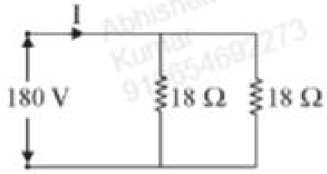
61. ***Ans. (d)***

$$V_B = 15$$

$$I=\frac{30-15}{30}=0.5\ A$$

62. ***Ans. (d)***

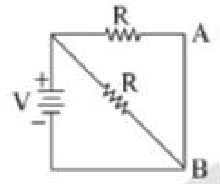
Redraw the circuit



$$I = \frac{180}{9} = 20 \text{ A}$$

$$I_6 = \frac{20\times18}{18+18} = 10 \text{ A}$$

63. *Ans. (b)*



$$I_S = \frac{V}{R/2} = \frac{2V}{R}$$

64. *Ans. (a)*

Voltage drop across internal resistance

$$= 100 - 80 = 20 \text{ V}$$

$\Rightarrow$ $20 = IR$

$\Rightarrow$ $20 = 2R$

$\Rightarrow$ $R = \frac{20}{2} = 10\ \Omega$

65. *Ans. (a)*

$$V = 100$$

$$I = \frac{100-100}{30} = 0\text{A}$$

66. *Ans. (a)*

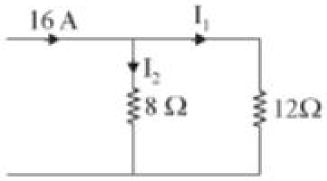
67. *Ans. (a)*

$$R_{eq} = \frac{\frac{1}{3}\times\frac{1}{4}}{\frac{1}{3}+\frac{1}{4}} = \frac{1}{7}\Omega$$

$$I = \frac{V}{R_{eq}} = \frac{1}{1/7} = 7\text{A}$$

68. *Ans. (d)*

69. *Ans. (b)*



Using current division rule

$$I_1 = I \times \frac{8}{20} = 16\times\frac{8}{20}$$

$$= 6.4 \text{ A}$$

$$I_2 = I \times \frac{12}{20}$$

$$= 16\times\frac{12}{20} = 9.6 \text{ A}$$

70. *Ans. (b)*

71. *Ans. (d)*

72. *Ans. (a)*

73. *Ans. (d)*

74. *Ans. (b)*

Total resistance = $6 \parallel 3 + 4 = 6\Omega$

Source current $i = \frac{12}{6} = 2\text{A}$

$$i_1 = \frac{6}{3+6}\times2 = 1.33 \text{ A}$$

$$P = I_1^2\times3 = 5.33 \text{ W}$$

75. *Ans. (b)*

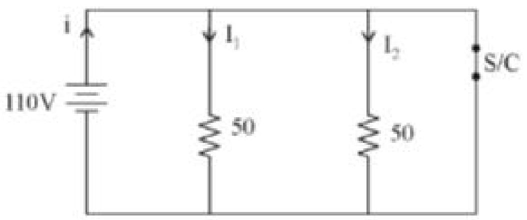
76. *Ans. (b)*

$$\frac{V_{ab}-1}{2}+\frac{V_{ab}}{2} = 3$$

$$2V_{ab} - 1 = 6$$

$$V_{ab} = 3.5 \text{ V}$$

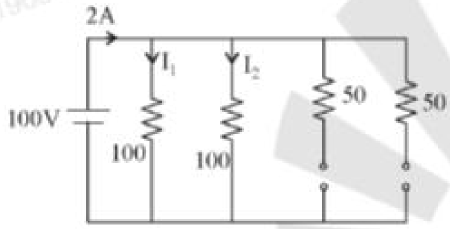
77. ***Ans.*** ***(a)***



$$I_1 = I_2 = 0$$

78. ***Ans.*** ***(a & d)***

79. ***Ans.*** ***(a)***



$$I_1 = I_2 = 1A$$

80. ***Ans.*** ***(a)***

$$I_1 = \frac{150}{50} = 3A$$

$$I_2 = \frac{150}{25} = 6A$$

81. ***Ans.*** ***(d)***

$$V_1 = i_s R_1 = 25 \times 10^{-3} \times 4 = 0.1V$$
$$V_2 = i_s R_2 = 25 \times 10^{-3} \times 8 = 0.2V$$

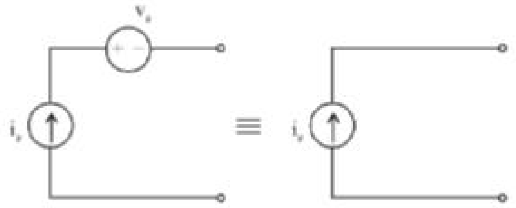
82. ***Ans.*** ***(b)***

When ideal voltage source & ideal current source are connected in parallel then current source will be removed.

$$\therefore \qquad V_R = i.R = i = \frac{15}{5} = 3 \text{ Amp}$$

$$P_R = \frac{V_r^2}{R} = \frac{(15)^2}{5} = 45 \text{ watt}$$

83. ***Ans.*** ***(a)***

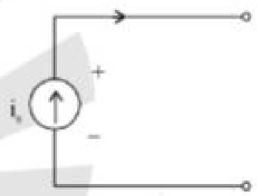


$$\therefore \qquad V_R = i_s.R = (3)\ (5) = (15) \text{ volt}$$

$$P_R = i_s^2 R = (3)^2(5) = (45) \text{ volt}$$

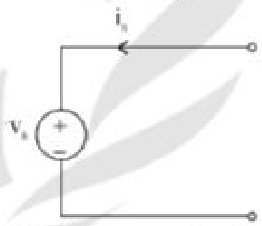
84. ***Ans.*** ***(b)***

$$\text{Power} = v_s i_s = (12)(13) = 36 \text{ watt}$$



Current source supplies power

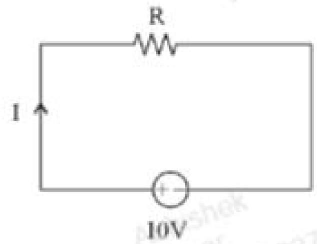
$$\therefore \qquad P_{supp} = +36 \text{ watt}$$



Voltage source absorbe power

$$\therefore \qquad P_{supp} = -36 \text{ watt}$$

85. ***Ans.*** ***(c)***



$$I = \frac{10}{R}$$

when $\qquad I = 40$ mA ;

$$R = \frac{10}{40\times10^{-3}} = 250\Omega$$

it is given that $i > 40$ mA ; so $R < 250\ \Omega$

Now power absorbed by resistance = I^2R

$= (40 \times 10^{-3})^2 \times 250$

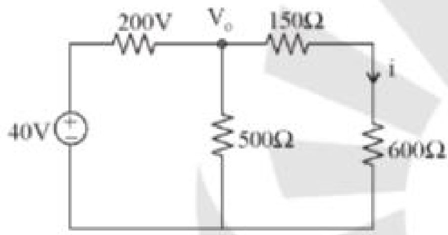
$= 0.4$ watt

Given $(p < 0.5)$

$$R = \frac{V^2}{P} = \frac{(10)^2}{0.5} = 200\ \Omega$$

$\therefore$ $200 < R < 250;\ R = 220\ \Omega$

86. ***Ans. (a)***



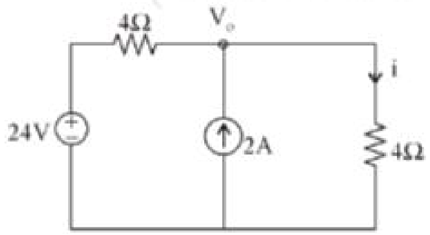
Using KCL

$$\frac{V_o - 40}{200} + \frac{V_o}{500} + \frac{V_o}{750} = 0$$

$V_o = 24$ Volt

$\therefore$ $$i = \frac{24}{750} = 32 \text{ mAmp}$$

87. ***Ans. (a)***



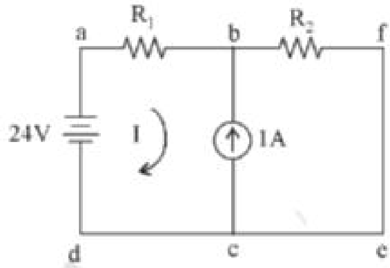
$$\frac{V_0 - 24}{4} + \frac{V_0}{4} - 2 = 0$$

$2V_o - 24 = 8$

$V_o = 16$ volt

$\therefore$ $$i = \frac{V_0}{4} = \frac{16}{4} = 4 \text{ Amp}$$

88. ***Ans. (d)***



Voltage source

$\therefore$ $P = VI$

$24 = 24I \Rightarrow I = 1$ Amp

current source

$$P = VI \Rightarrow V = \frac{6}{1} = 6 \text{ volt}$$

loop a b c d a ;

$(24 - 6) = 1 \times R_1$

$R_1 = 18\ \Omega$

loop bcefb;

$6 = (1 + 1)R_q$

$R_q = 3\ \Omega$

89. ***Ans. (d)***

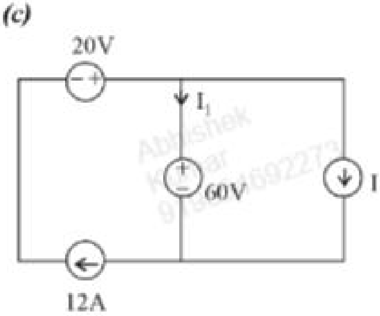
$$I \propto \frac{1}{R}$$

90. ***Ans. (c)***

$I_{AB} = 1 + 1 = 2$ Amp

$R_{AB} = 10 \parallel 10 = 5\ \Omega$

91. ***Ans. (c)***



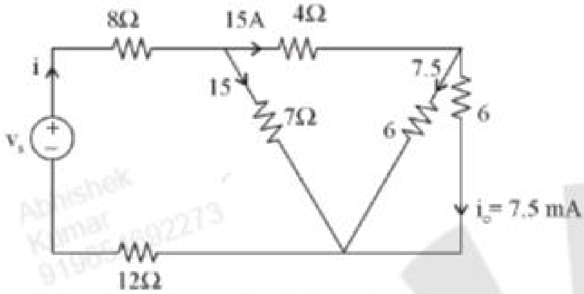
$\because$ 60V = Absorb power

So, $I + I_1 = 12$

$I = 12 - I$

$I < 12$

92. *Ans. (b)*



$i_0 = 7.5$ mA

$\therefore$ $i = 30$ mA

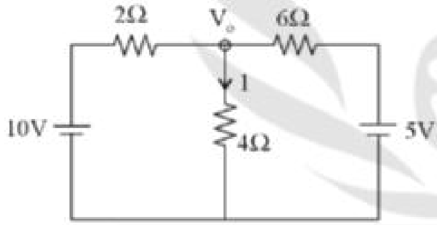
$$R_{eq} = 8+12+\frac{7}{2}$$

$= 23.5\ \Omega$

so, $v_s = i.R_{eq} = 30 \times 23.5$

$= 705$ mvolt

93. *Ans. (a)*



$$\frac{V_0-10}{2}+\frac{V_0}{4}+\frac{V_0-5}{6}=0$$

$6V_0 - 60 + 3V_0 + 2V_0 - 10 = 0$

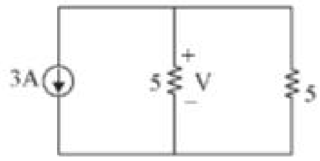
$$11V_0 = 70 \Rightarrow V_0 = \frac{70}{11}\text{volt}$$

$$\therefore \quad i = \frac{V_0}{4} = \frac{70}{11}/4 = \frac{35}{22}\text{Amp.}$$

94. *Ans. (b)*

$I_T = 2.5 - 2.5 + 3$

$= 3$ A

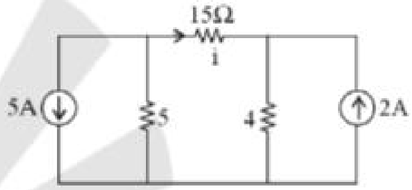


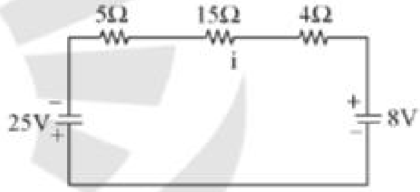
$V = i.R$

$$= \left(\frac{3}{2}\right)(5)$$

$= 7.5$ volt.

95. *Ans. (b)*

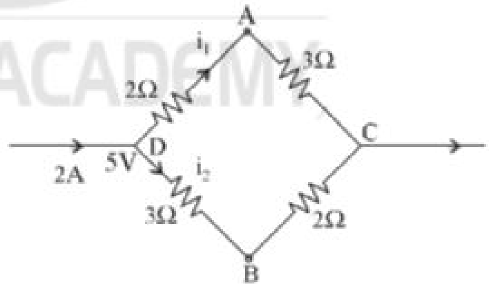




$$i = \frac{(25+8)}{(5+4+15)}$$

$$= \frac{33}{24} = 1.375\text{ Amp}$$

96. *Ans. (b)*



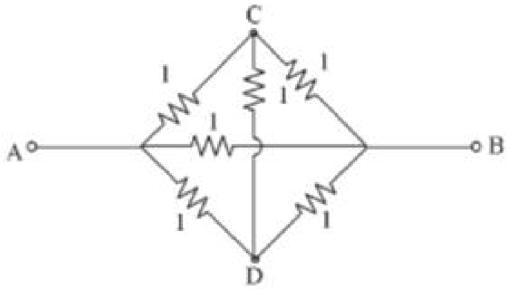
$i_1 = i_2 = 1$A

$V_A = 5 - 2i_1 = 3$ volt

$V_B = 5 - 3i_2 = 2$ volt

so, $V_A - V_B = 3 - 2 = (1)$ volt

97. Ans. (b)



$\because$ Bridge is balanced

So, Branch CD eleminated

$\therefore \quad R_{AB} = 2 \parallel 2 \parallel 1$

98. Ans. (a)

$$i = \frac{24}{R_{eq}}$$

$$R_{eq} = 8 \parallel 12 = 4.8\ \Omega$$

So, $$i = \frac{24}{4.8} = 5 \text{ Amp.}$$

99. Ans. (a)

$$\text{Ammeter reading} = i = \frac{100}{R_{eq}}$$

$$R_{eq} = 2 + [16 \parallel \{6 + 20 \parallel 20\}]$$

$$= 2 + [16 \parallel 16] = 10\ \Omega$$

so, $$i = \frac{100}{10} = 10 \text{ Amp}$$

100. Ans. (d)

$$i = \frac{V}{R_{eq}} \ ; \ R_{eq} = 200 \parallel 100$$

$$= \frac{200}{3}\ \Omega$$

$$i = \frac{100}{200/3} = 1.5 \text{ Amp}$$

101. Ans. (a)

$$P = \frac{V^2}{R} = \frac{(240)^2}{240} = 240 \text{ watt}$$

102. Ans. (a)

103. Ans. (d)

104. Ans. (d)

$$R_{eq} = (3 \parallel 6) + 1 = 3\Omega$$

$$P = \frac{V^2}{R_{eq}} = \frac{(3)^2}{3} = 3 \text{ watt}$$

105. Ans. (b)

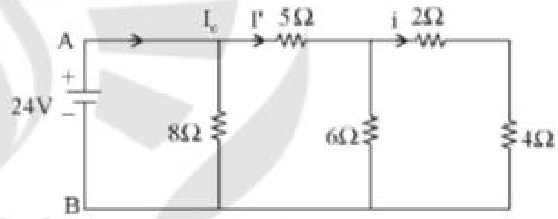
106. Ans. (b)

$$I_1 + I_4 = I_2 + I_3$$

$$\Rightarrow \quad 7 + 3 = 2 + I_3$$

$$\Rightarrow \quad I_3 = 8 \text{ Amp}$$

107. Ans. (d)



$$R_{AB} = 4\ \Omega \ ; \ I = \frac{24}{4} = 6 \text{ Amp}$$

$$I' = \frac{6}{2} = 3 \text{ A} \ , \ i = \frac{3}{2} = 1.5\text{A}$$

108. Ans. (a)

$$I = \left(\frac{6}{6+3}\right) 15\text{mA}$$

$$= 10 \text{ mA}$$

109. Ans. (d)

110. Ans. (b)

$$12 = 0.26(0.5 + 20 + 10 + R)$$

$$\Rightarrow \quad 30.5 + R = \frac{12}{0.26}$$

$$\Rightarrow \quad R = 15.6\ \Omega$$

111. *Ans. (b)*

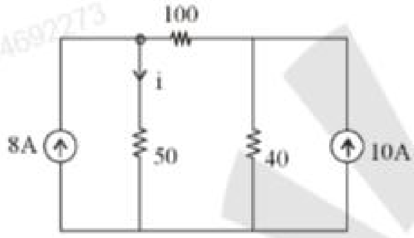
Power $\quad P = \dfrac{V^2}{R}$

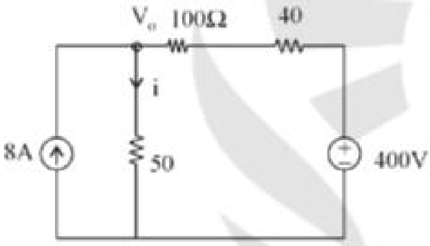
($\because$ connected in parallel)

$$\uparrow P \propto \frac{1}{R} \downarrow$$

So, Power dissipated in R_2 is higher

112. *Ans. (b)*





By K.C.L $\quad \dfrac{V_0}{50} - 8 + \dfrac{V_0 - 400}{140} = 0$

$\Rightarrow \quad 14V_0 - 5600 + 5V_0 - 2000 = 0$

$\Rightarrow \quad 19\ V_0 = 7600$

$\Rightarrow \quad V_0 = 400$ volt

so $\quad i = \dfrac{V_0}{50} = \dfrac{400}{50} = 8$ Amp

$\therefore \quad P = i^2R = (8)^2 \times 50 = 3200$

$= 3.2$ kW

113. *Ans. (a)*

$$I_1 = \left(\frac{6}{6+3}\right)9 = 6\ \text{A}$$

$$I_2 = 9 - 6 = 3\ \text{A}$$

114. *Ans. (a)*

$$(V)_{14.5} = \frac{14.5}{(14.5+26.5+60)} \times 200$$

$$= \frac{14.5 \times 200}{101}$$

$$= 28.71 \simeq 29 \text{ volt}$$

115. *Ans. (d)*

116. *Ans. (c)*

$I_1 + I_2 = I_3 + I_4$

$\Rightarrow \quad 4 + 2.5 = 2 + I_4$

$\Rightarrow \quad I_4 = 4.5$ Amp

117. *Ans. (a)*

$i = 4$;

$I = 3 - 1.3 = 1.7$ Amp

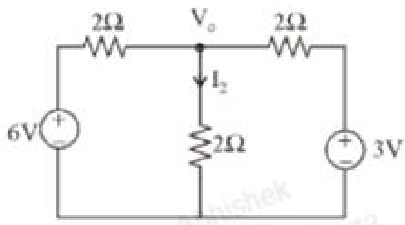
118. *Ans. (b)*

119. *Ans. (b)*

$$(I)_{5\Omega} = \left(\frac{2}{2+5}\right)10$$

$$= \frac{20}{7} = 2.85 \text{ Amp}$$

120. *Ans. (c)*

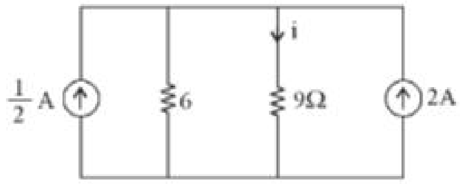


$$\frac{V_0 - 6}{2} + \frac{V_0}{2} + \frac{V_0 - 3}{2} = 0$$

$\Rightarrow \quad V_0 = 3$ volt

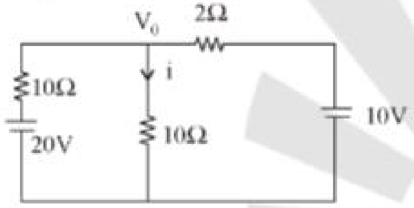
$$\therefore \quad I_2 = \frac{V_0}{2} = = \frac{3}{2} = 1.5 \text{ Amp}$$

121. *Ans. (d)*



$$i = \left(\frac{6}{15}\right)\left(\frac{5}{2}\right) = 1 \text{ Amp.}$$

122. *Ans. (b)*



$$\frac{V_0 - 20}{10} + \frac{V_0}{10} + \frac{V_0 - 10}{2} = 0$$

$$\Rightarrow \quad V_0 - 20 + V_0 + 5V_0 - 50 = 0$$

$$\Rightarrow \quad 7V_0 = 70$$

$$\Rightarrow \quad V_0 = 10 \text{ Volt.}$$

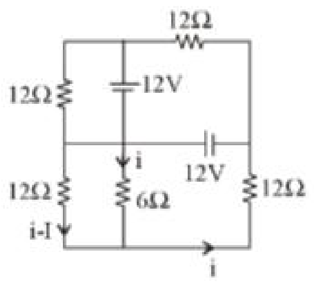
$$\therefore \quad i = \frac{V_0}{10} = \frac{10}{10} = 1 \text{ Amp.}$$

123. *Ans. (d)*

Current in 'E_2' branch $= I_1 - I_2$

$= 5 - 4 = 1$ (charging)

124. *Ans. (c)*



$$i = \frac{12}{R_{eq}}$$

$$R_{eq} = (12 \parallel 6) + 12$$

$$= 16\Omega$$

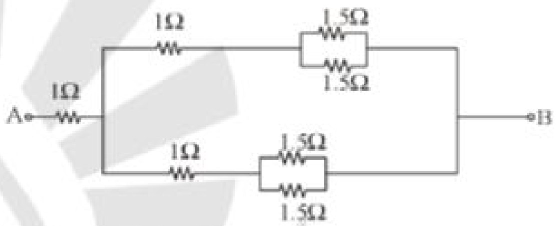
$$\therefore \quad i = 0.75 \text{ Amp.}$$

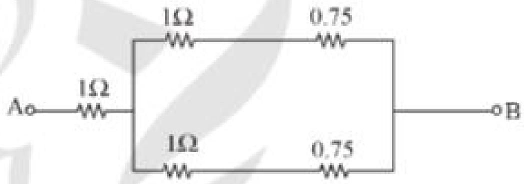
So, $(12)\,(0.75 - I) = I\,(6)$

$$\Rightarrow \quad 9 - 12\,I = 6I$$

$$\Rightarrow \quad I = \frac{1}{2} \text{ Amp}$$

125. *Ans. (a)*





$$R_{AB} = 1 + \left(\frac{1.75}{2}\right)$$

$$= 1.875\ \Omega$$

126. *Ans. (b)*

$$i = \frac{(120 - 30)}{(30 + 15)} = \frac{90}{45} = 2 \text{ Amp}$$

$$\therefore \quad P = Vi = (120)\,(2)$$

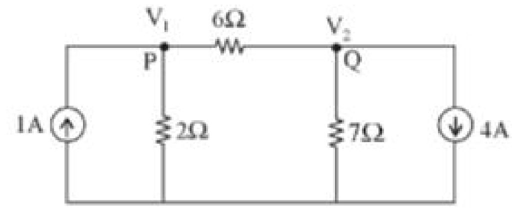
$$= 240 \text{ Watt}$$

127. *Ans. (c)*

$$i = \frac{8}{4} = 2 \text{ Amp}$$

$$\therefore \quad V_x = 8 + 2(2) = 12 \text{ Volt}$$

128. ***Ans. (d)***



At node 'P' (By kcl)

$$-1+\frac{V_1}{2}+\frac{V_1-V_2}{6}=0$$

$$-6+3V1+V_1-V_2=0$$

$$4V_1 - V_2 = 6 \qquad ...(1)$$

At Node 'Q' (By Kcl)

$$\frac{V_2-V_1}{6}+\frac{V_2}{7}+4=0$$

$$\Rightarrow 7V_2-7V_1+6V_2+168=0$$

$$\Rightarrow 13V_2 - 7V_1 + 168 = 0 \qquad ...(2)$$

From equation (1) & (2) ;

$$V_1 = -2 \text{ volt}$$

129. ***Ans. (c)***

$$V_{ab} = -5 + 3 -1$$
$$= -3 \text{ volt}$$

130. ***Ans. (d)***

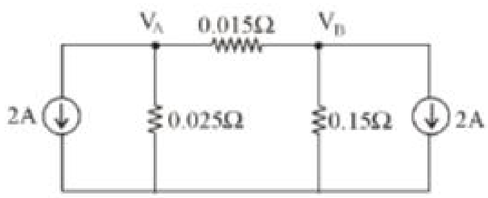
Current entering at Node 'b' = 5 – 2

= 3A

So, $V_{ba} = 5 \times 3 = 15$ volt

$V_{ab} = -15$ volt

131. ***Ans. (a)***



Using KCL at Node 'A'

$$2+\frac{V_A}{0.025}+\frac{V_A-V_B}{0.015}=0 \qquad ...(1)$$

Using KCL at Node 'B'

$$2+\frac{V_B}{0.015}+\frac{V_B-V_A}{0.015}=0 \qquad ...(2)$$

From Eq. (1) & (2)

$$V_A = -75 \text{ Volt}$$

132. ***Ans. (c)***

$$24 = I(3+R)$$

$$\Rightarrow \quad 3 + R = \frac{24}{2} = 12$$

$$R = 9\Omega$$

133. ***Ans. (b)***

$$(I)_{3\Omega} = \frac{V}{R}=\frac{30}{3} = 10 \text{ Amp}$$

134. ***Ans. (c)***

135. ***Ans. (d)***

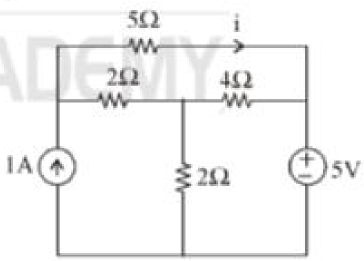
When R_2 will be open circuited, then whole current of circuit will be zero & (V) Reading is equal to 200 Volt.

136. ***Ans. (a)***

$$i = \frac{V_A-V_B}{30}=\frac{100-100}{30}$$

$$= 0 \text{ Amp.}$$

137. ***Ans. (d)***



$$R' = 2 + (4 \parallel 2)$$

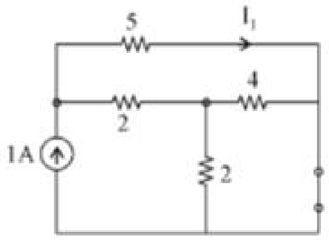
$$= 2+\frac{8}{6}=\frac{20}{6}=\frac{10}{3}$$

$$i = I_1 + I_2$$

From superposition,

⇒ When only current source will exist;

Current in 5Ω resistance is I_1.

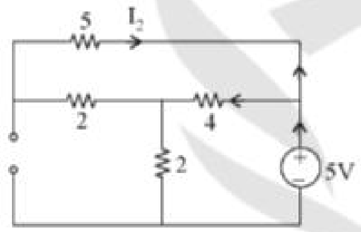


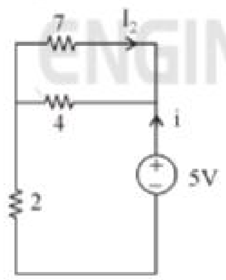
$$I_1 = \left(\frac{\frac{10}{3}}{5+\frac{10}{3}}\right)1$$

$$= \frac{10}{25} = \frac{2}{5}\text{ Amp}$$

$$= 0.4 \text{ Amp}$$

Now only when 5V source exist.





$$R' = (7 \parallel 4) + 2$$

$$= \frac{28}{11} + 2 = \frac{50}{11}$$

$$i = \frac{5}{50/11} = \frac{11}{10}$$

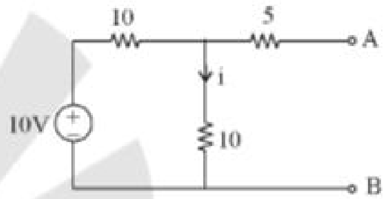
$$\therefore \quad I_2 = \left(\frac{-4}{10}\right)\left(\frac{11}{10}\right)$$

$$= -0.4 \text{ Amp}$$

So, $I = I_1 + I_2$

$$= 0.4 + (-0.4) = 0 \text{ Amp.}$$

138. ***Ans. (a)***



$$V_{th} = i(10)$$

$$= \left(\frac{10}{20}\right)(10)$$

$$= 5 \text{ Volt}$$

$$R_{th} = 5 + (10 \parallel 10)$$

$$= 10\Omega$$

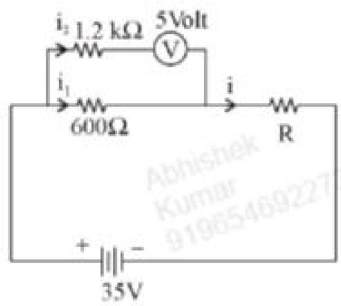
139. ***Ans. (c)***

By Node Analysis;

$$\frac{V_A - 12}{49} + \frac{V_A}{24} + \frac{V_A - 6}{80} = 0$$

$$V_A = 4.25 \text{ Volt}$$

140. ***Ans. (b)***



$\therefore \quad (1.2 \times 10^3)i_2 = 5$

$$\Rightarrow \quad i_2 = \frac{5}{1200} = \frac{1}{240}$$

$$5 = 600(i_1)$$

$$i_1 = \frac{1}{120}\text{A}$$

$$i = \frac{1}{120} + \frac{1}{24}$$

$$= \frac{1}{80}\text{Amp.}$$

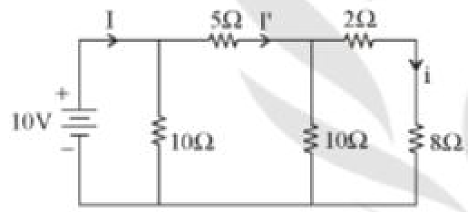
$$V_R = 35 - 5 = 50 = i.R$$

$$\Rightarrow \quad R = \frac{30}{\left(\frac{1}{80}\right)} = 2400$$

$$= 2.4\ \text{k}\Omega$$

141. ***Ans. (a)***

142. ***Ans. (b)***



$$R_{eq} = 5\Omega$$

$$I = \frac{10}{5} = 2$$

$$I' = \left(\frac{10}{10+10}\right)^2 = 1\text{A}$$

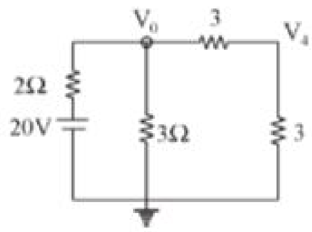
$$i = \frac{1}{2} = 50\ \text{Amp}$$

143. ***Ans. (a)***

$$R_{eq} = 660 \| 660$$

$$= 330\ \Omega$$

144. ***Ans. (b)***



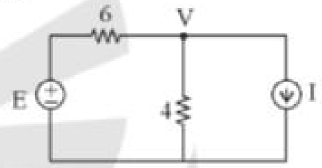
$$\frac{V_0 - 12}{2} + \frac{V_0}{3} + \frac{V_2}{6} = 0$$

$$\Rightarrow \quad V_0 = 6\ \text{volt}$$

$$\therefore \quad V_4 = \frac{6}{2} = 3\ \text{volt}$$

145. ***Ans. (c&d)***

146. ***Ans. (c)***

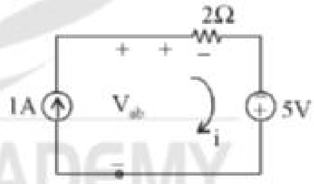


By Applying KCL;

$$\frac{V - E}{6} + \frac{V}{4} + I = 0$$

$$\Rightarrow \quad V = 0.4E - 2.4I$$

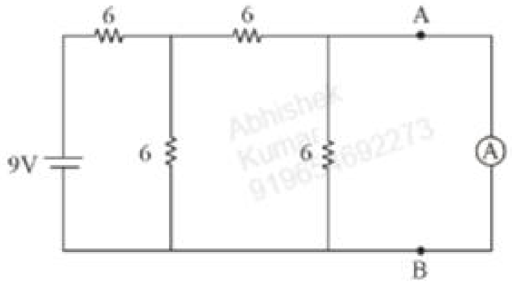
147. ***Ans. (a)***

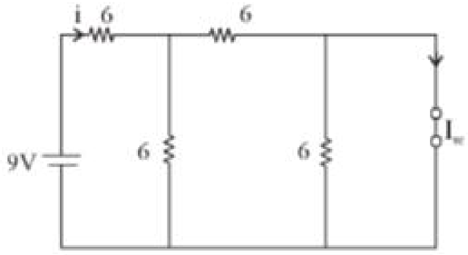


$$2i - 5 = V_{ab}$$

$$V_{ab} = 2(1) - 5 = -3V$$

148. ***Ans. (c)***



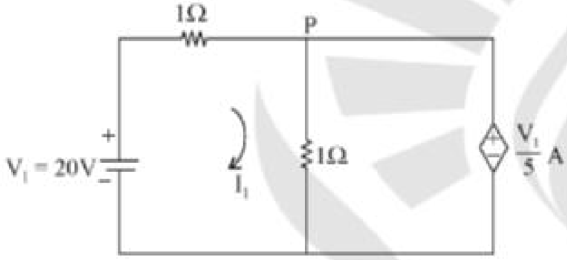


$$R = 6 + (6 \parallel 6) = 9\Omega$$

$$\therefore \quad i = \frac{9}{9} = 1 \text{ A}$$

$$I_{sc} = \frac{1}{2} = 0.5\text{Amp}$$

149. ***Ans. (b)***



Apply KCL at Node (P)

$$\frac{V_P - 20}{1} + \frac{V_P}{1} - \frac{V_1}{5} = 0$$

$$\Rightarrow V_P - 20 + V_P = \frac{20}{5}$$

$$\Rightarrow \quad V_P = 12 \text{ V}$$

Now Power

$$P = VI = 12 \times 4 = 48\text{W}$$

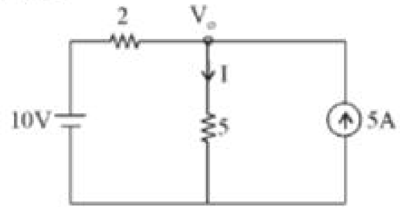
Source deliver 48 Watt

150. ***Ans. (d)***

Both sources are in parallel.

So, $\quad I = \frac{V}{R} = \frac{1}{1} = 1 \text{ Amp.}$

151. ***Ans. (c)***



$$\frac{V_0 - 10}{2} + \frac{V_0}{5} - 5 = 0$$

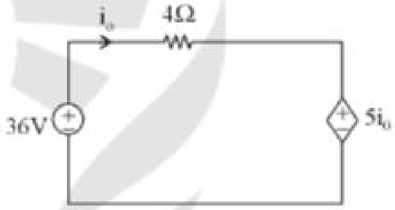
$$\Rightarrow \quad 5V_0 - 50 + 2V_0 = 50$$

$$\Rightarrow \quad 7V_0 = 100$$

$$\Rightarrow \quad V_0 = \frac{100}{7}$$

$$\therefore \quad I = \frac{V_0}{5} = \frac{\frac{100}{7}}{5} = \frac{20}{7}\text{Amp}$$

152. ***Ans. (d)***



By KVL

$$-36 + 4i_0 + 5i_0 = 0$$

$$9i_0 = 36$$

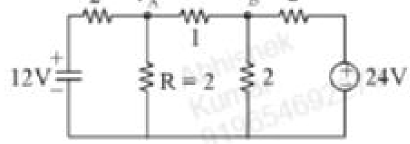
$$i_0 = 4 \text{ Amp.}$$

153. ***Ans. (c)***

$$V_{AB} = I\,R_{eq} = 3 \times [2 + (2 \parallel 8)]$$

$$= 3\,[2 + 1.6] = \frac{54}{5} \text{ Volt.}$$

154. ***Ans. (d)***



$$\frac{V_A - 12}{2} + \frac{V_A}{2} + \frac{V_A - Y_B}{1} = 0 \qquad ...(1)$$

$$\frac{V_A - 24}{2} + \frac{V_B}{2} + \frac{V_B - V_A}{1} = 0 \qquad \ldots(2)$$

From eq (1) & (2) ;

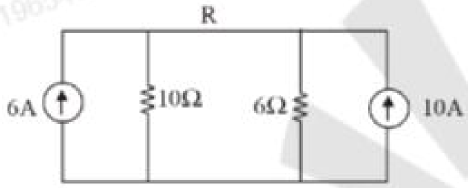
$$V_A = 8 \text{ volt}$$

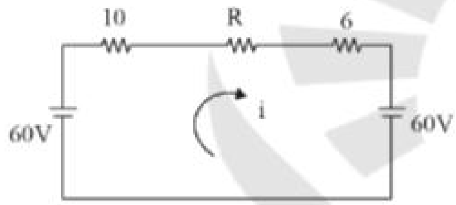
$$V_B = 10 \text{ V}$$

$$\therefore \text{ Power loss in 'R'} = \frac{V_A^2}{R} = \frac{(8)^2}{2}$$

$$= 32 \text{ watt}$$

155. *Ans. (b)*



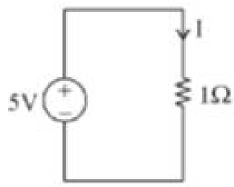


$$i = \frac{E_{eq}}{R+16} = \frac{60-60}{R+16}$$

$$= 0$$

$$\therefore \quad \text{Power loss} = i^2R = 0$$

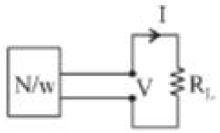
156. *Ans. (c)*



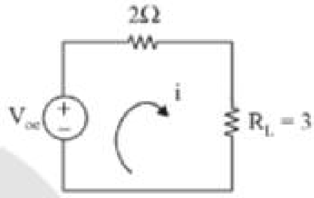
$$I = \frac{5}{1}$$

$$= 5 \text{ Amp}$$

157. *Ans. (c)*



$$R_{th} = \frac{V_{oc}}{I_{sc}} = \frac{20}{10} = 2\ \Omega$$



$$i = \frac{20}{2+3}$$

$$= 4 \text{ Amp.}$$

158. *Ans. (d)*

$$\frac{V - V_A}{2} + \frac{V-5}{5} = 1$$

$$7V - 5V_A = 20 \qquad \ldots(1)$$

$$\frac{V_A - V}{2} + \frac{V_A}{2} + \frac{V_A - 5}{4} = 0$$

$$5V_A - 2V = 5 \qquad \ldots(2)$$

From equation (1) and (2)

$$V = 5$$

$$I = \frac{5-5}{5} = 0 \text{ A}$$

❑❑❑

CHAPTER 3

NETWORK THEOREM

OBJECTIVE QUESTIONS

1. Superposition theorem is not applicable to network containing

(a) Non linear elements

(b) Dependent voltage source

(c) Dependent current source

(d) Transformer

2. Which of the following theorems can be applied to any network linear of non-linear, active or passive, time variant or time invariant ?

(a) Thevenin theorem

(b) Norton theorem

(c) Tellegen theorem

(d) Superposition theorem

3. If the source impedance is capacitive, for maximum transfer of power from the source to the load, the load should be

(a) Capacitive

(b) Resistive

(c) Complex conjugate of complex source impedance

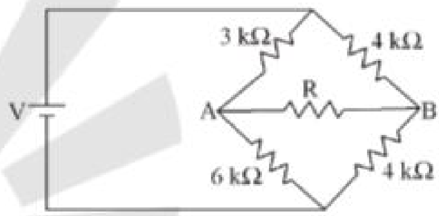
(d) Exactly the same as the source impedance

4. A source of V volt has an internal impedance Z_{in}= (R + jX). When it is connected to load of Z_L = R – jX. The power transferred is

(a) $\frac{V^2}{4R^2}$ (b) $\frac{V^2}{4R}$

(c) $\frac{V^2}{R}$ (d) $\frac{V^2}{2R^2}$

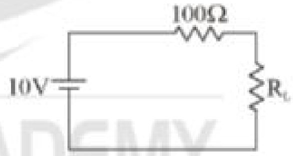
5. The value of the resistance R connected across the terminals A and B, which will absorb the maximum power is



(a) 4 kΩ (b) 4.11 Ω

(c) 8 kΩ (d) 9 kΩ

6. The maximum power that can be transferred to the load R_L from the voltage source in figure is



(a) 1 W (b) 10 W

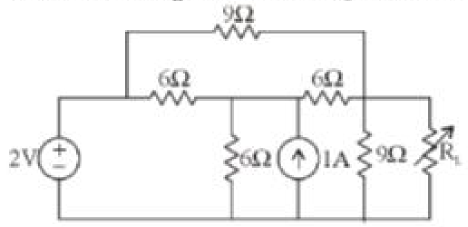
(c) 0.25 W (d) 0.5 W

7. A voltage source having a source impedance $Z_s = R_s + jX_s$ can deliver maximum average power to load

(a) $Z_L = R_s + jX_s$ (b) $Z_L = R_s$

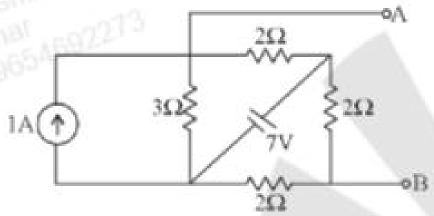
(c) $Z_L = jX_s$ (d) $Z_L = R_s - jX_s$

8. The value of R_L for maximum power transfer is



(a) 3 Ω (b) 1.125 Ω
(c) 4.1785 Ω (d) None of these

9. The thevenin impedance across the terminal A and B in given figure is



(a) 2.2 Ω (b) $\frac{20}{9}$Ω

(c) 9 Ω (d) $\frac{5}{11}$Ω

10. The thevenin equivalent of the network shown in figure (a) is 10 V in series with a resistance of 2 Ω. If now, a resistance of 3 Ω is connected across AB as shown in figure (b), the thevenin equivalent of the modified network across AB will be

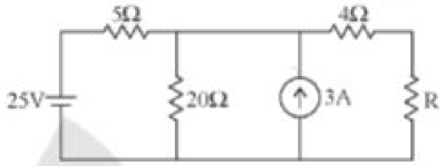
(a) (b)

(a) 10 V in series with 1.2 Ω resistance
(b) 6 V in series with 1.2 Ω resistance
(c) 10 V in series with 5 Ω resistance
(d) 6 V in series with 5 Ω resistance

11. Which of the following is incorrect with regard to reciprocity theorem?
(a) Applicable for single voltage source
(b) Initial conditions are assumed to be zero
(c) There should not be any extra dependent or independent sources in network
(d) None of these

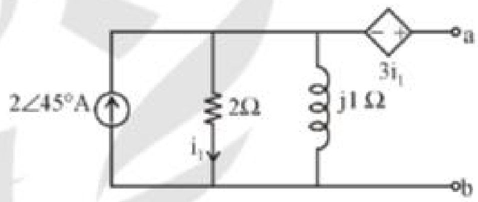
12. When a source is delivering maximum power to a load, the efficiency of the circuit.
(a) Is always 50%
(b) Is always 75%
(c) Is always 100%
(d) Depends on the circuit parameters.

13. The value of R required for maximum power transfer in the network shown in figure is



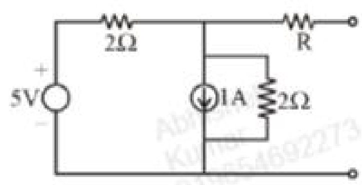
(a) 2 Ω
(b) 4 Ω
(c) 8 Ω
(d) 16 Ω

14. The Norton equivalent admittance (in S) with respect to terminals 'ab' of the circuit shown in figure is



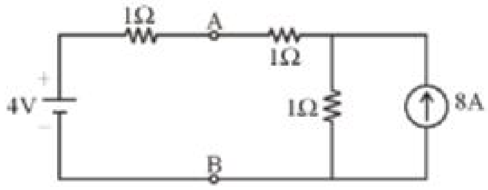
(a) 0.2 – j0.4
(b) 0.1 – j0.2
(c) 1 – j2
(d) 5 + j2.5

15. If Thevenin equivalent resistance of the given circuit seen from the open terminal is 2Ω, then the value of 'R' will be



(a) 4Ω (b) 2Ω
(c) 1Ω (d) zero

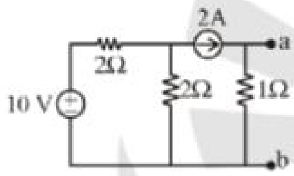
16. What is the Thevenin's equivalent between A and B for the circuit shown below?

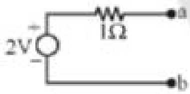


(a) 12V, $\frac{3}{2}\Omega$ (b) 4V, $\frac{3}{2}\Omega$

(c) $\frac{16}{3}$V, $\frac{2}{3}\Omega$ (d) $\frac{16}{3}$V, 3Ω

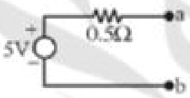
17. The thevenin equivalent of the network shown in the below figure is



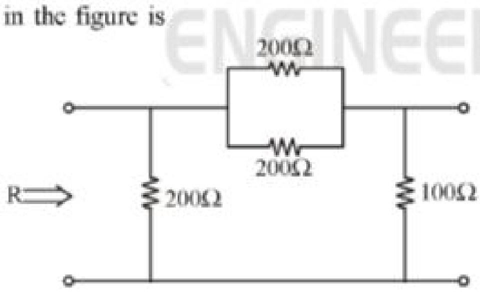
(a) 

(b) 

(c) 

(d) 

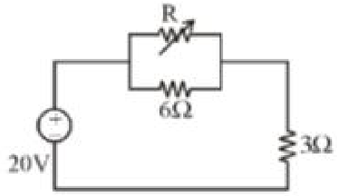
18. The equivalent resistance R for the network shown in the figure is



(a) 200 ohms (b) 101 ohms

(c) 220 ohms (d) 100 ohms

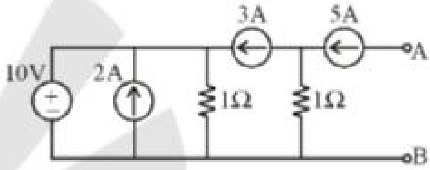
19. In the circuit shown, for the maximum power dissipation in the 6Ω resistor, the value of 'R' is



(a) 0 (b) 3 Ω

(c) 6 Ω (d) ∞

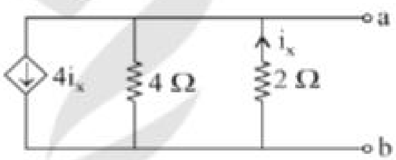
20. In the circuit shown, the Thevenin's equivalent across A, B is



(a) 2V, 1Ω (b) 5V, 1Ω

(c) 2V, 0.5 Ω (d) Not possible

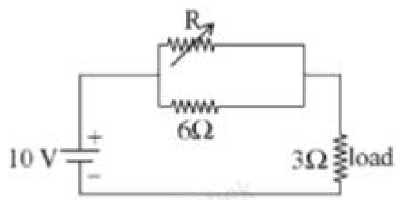
21. The Thevenin's voltage across the terminal ab in circuit is given below



(a) 1 V (b) 2 V

(c) 0 V (d) ∞

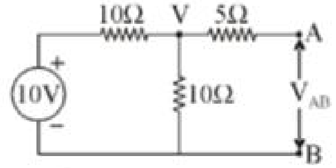
22. In the circuit given below, the value of R required for the transfer of maximum power to the load having a resistance of 3Ω will be?



(a) 3Ω (b) 10Ω

(c) 0Ω (d) 9Ω

23. For the circuit given in the fig, the thevenis's voltage and resistance as seen at AB are represented by:



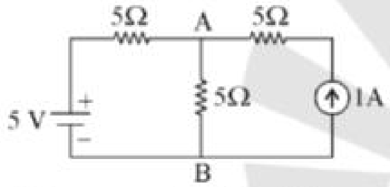
(a) 5 V, 10 Ω

(b) 10V, 10 Ω

(c) 5 V, 5 Ω

(d) 54V, 15 Ω

24. Find the Thevenin's voltage across the points A and B in the following circuit:



(a) 5V (b) 10 V

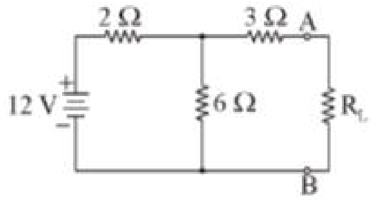
(c) 15 V (d) 12.5 V

25. In the maximum power transfer theorem, power delivered to load resistance is given by:

(a) $P_{max} = \frac{V_{TH}^2}{4R_{TH}}$ (b) $P_{max} = \frac{V_{TH}}{4R_{TH}}$

(c) $P_{max} = \frac{V_{TH}^2}{4R_{TH}^2}$ (d) $P_{max} = \frac{V_{TH}}{4R_{TH}^2}$

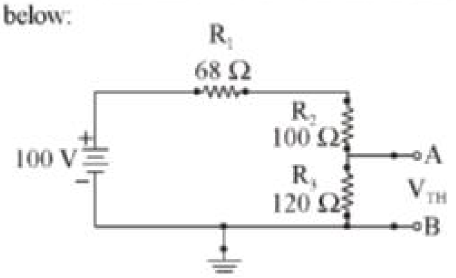
26. For the given circuit, the value of Norton's equivalent Resistance is:



(a) 4.5 Ω (b) 5 Ω

(c) 6 Ω (d) 10 Ω

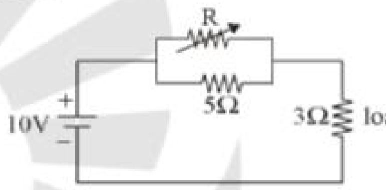
27. Find the Thevenin equivalent (V_{TH} and R_{TH}) between terminals A and B of the circuit given below:



(a) 4.16 V, 120 Ω (b) 41.6 V, 120 Ω

(c) 4.16 V, 70 Ω (d) 41.67 V, 70 Ω

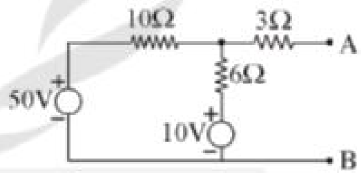
28. In the circuit given below, find the maximum power and the value of R required for the transfer of maximum power to the load having a resistance of 3Ω.



(a) 6Ω and 8.33 W (b) 6Ω and 16.67 W

(c) 0Ω and 33.33 W (d) 0Ω and 16.67 W

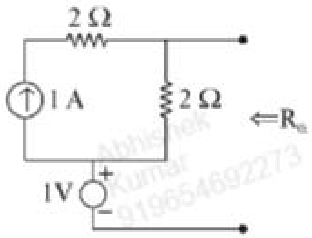
29. Find the Thevenin Equivalent Resistance (R_{th}) for the given circuit.



(a) 6 Ω (b) 6.25 Ω

(c) 6.75 Ω (d) 7 Ω

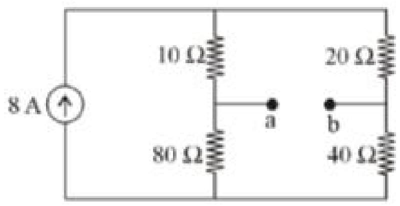
30. The Thevenin's equivalent circuit resistance R_{th} for the given network is



(a) 1 Ω (b) 2 Ω

(c) 4 Ω (d) Infinity

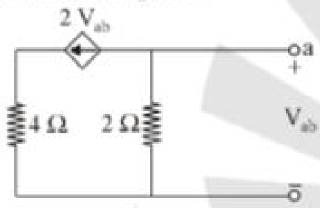
31. The Norton's resistance between termianls a and b of the circuit is



(a) $\frac{240}{7}\Omega$ (b) 36 Ω

(c) 150 Ω (d) 24 Ω

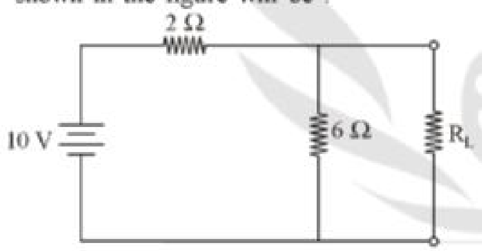
32. The Thevenin equivalent resistance (R_{th}) for the circuit shown in fig. is :



(a) 4 Ω (b) 0.4 Ω

(c) 0.5 Ω (d) 2 Ω

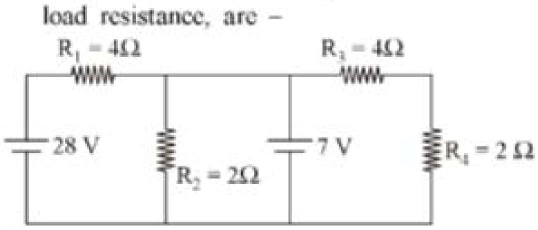
33. Thevenin's equivalent E_{th} and R_{th} for the circuit shown in the figure will be :



(a) 16.5 V, 6 Ω (b) 12.5 V, 3 Ω

(c) 10.5 V, 2 Ω (d) 7.5 V, 1.5 Ω

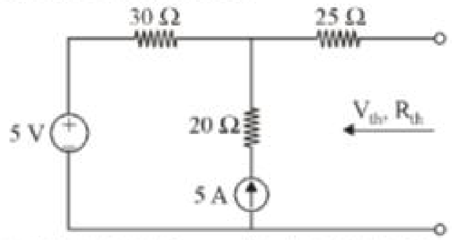
34. Thevenin's equivalent voltage and resistance for the circuit shown, when R_2 is considered as the load resistance, are –



(a) 7 V and 0Ω (b) 21 V and 7Ω

(c) 28 V and 0Ω (d) 7 V and 7Ω

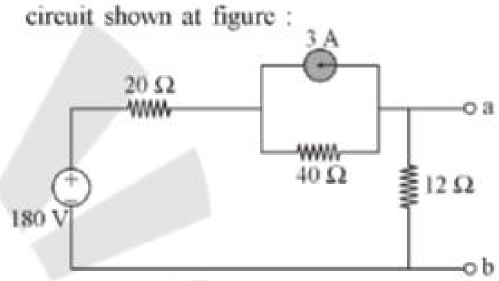
35. For the given circuit find the equivalent thevenin's voltage and resistance.



(a) 100 V, 75 Ω (b) 100 V, 55 Ω

(c) 155 V, 75 Ω (d) 155 V, 55 Ω

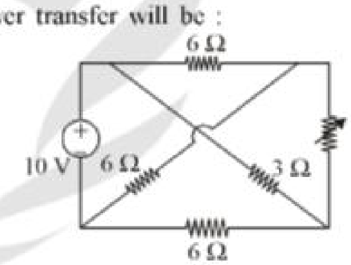
36. The Norton current at terminals a and b of the circuit shown at figure :



(a) 1 A (b) –2A

(c) 2 A (d) 3 A

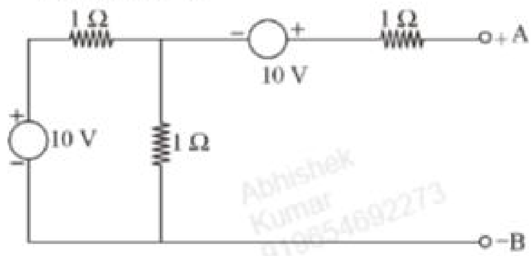
37. The value of variable resistor for maximum power transfer will be :



(a) 5 Ω (b) 10 Ω

(c) 15 Ω (d) 25 Ω

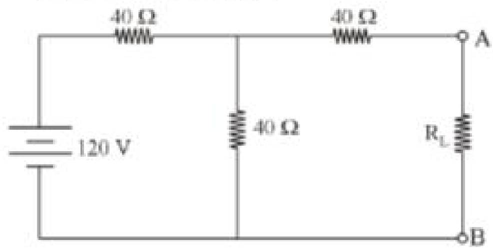
38. In the given circuit, thevenin voltage across the terminal AB is



(a) –15 V (b) 15 V

(c) 5 V (d) 0V

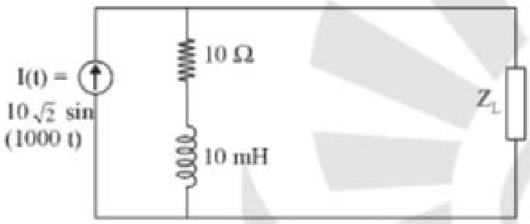
39. Calculate the value of load resistance R_L to which maximum power may be transferred from the source shown in figure



(a) 33.73 ohm (b) 60 ohm

(c) 73.33 ohm (d) 100 ohm

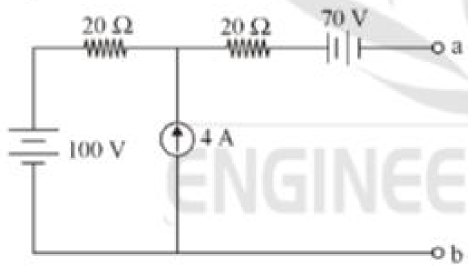
40. In the circuit, the maximum power that can be transferred to Load Z_L is



(a) 250 W (b) 500 W

(c) 1000 W (d) 200 W

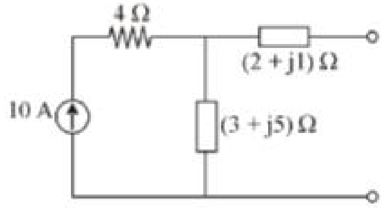
41. The thevenin equivalent for the network of the figure is :



(a) 110 V, 10 Ω (b) 110 V, 40 Ω

(c) 30 V, 40 Ω (d) 30 V, 10 Ω

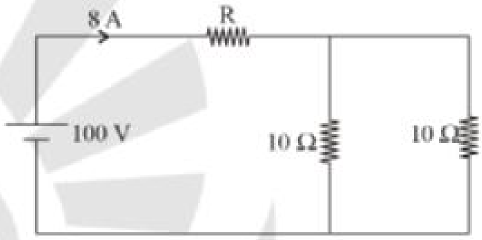
42. The impedance in the Norton equivalent of the circuit shown in figure is :



(a) $(5 + j6)\Omega$ (b) $\frac{(-73+71j)}{14}\Omega$

(c) $(3 + j5)\Omega$ (d) $(1 + j4)\Omega$

43. In the figure below the value of R is



(a) 2.5 Ω (b) 5.0 Ω

(c) 7.5 Ω (d) 10.0 Ω

❑❑❑

Answer Key

1. *Ans. (a)*
2. *Ans. (c)*
3. *Ans. (c)*
4. *Ans. (b)*
5. *Ans. (a)*
6. *Ans. (c)*
7. *Ans. (d)*
8. *Ans. (a)*
9. *Ans. (a)*
10. *Ans. (b)*
11. *Ans. (d)*
12. *Ans. (a)*
13. *Ans. (c)*
14. *Ans. (a)*
15. *Ans. (c)*
16. *Ans. (c)*
17. *Ans. (a)*
18. *Ans. (d)*
19. *Ans. (d)*
20. *Ans. (d)*
21. *Ans. (c)*

$$\frac{V_{ab}}{2}+\frac{V_{ab}}{4}+4i_x = 0$$

$$i_x = -\frac{V_{ab}}{2}$$

$$\frac{V_{ab}}{2}+\frac{V_{ab}}{4}-2V_{ab} = 0$$

$$\Rightarrow \quad V_{ab} = 0$$

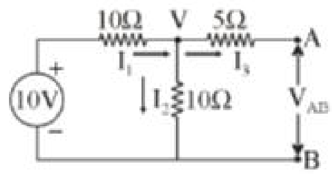
22. *Ans. (c)*

Since load is constant.

So for maximum power transfer R must be zero.

$$P_{max} = \frac{V^2}{R} = \frac{100}{3} = 33.33 \text{ W}$$

23. *Ans. (a)*



Apply KCL at V node

$I_1 = I_2 + I_3$ ($I_3 = 0$ because A and B open circuit)

$$\frac{10-V}{10} = \frac{V-0}{10}+0$$

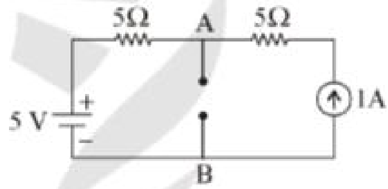
$$2V = 10 \Rightarrow V = 5 \text{ Volt}$$

No current in 5Ω resistance

So $\quad V_{AB} = V = 5$ volt

$$R_{th} = \frac{10\times10}{10+10}+5\Omega = 10\ \Omega$$

24. *Ans. (b)*



$$\frac{V_{AB}-5}{5} = 1$$

$$\Rightarrow \quad V_{AB} = 5 + 5$$

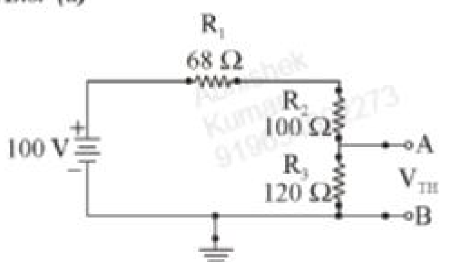
$$\Rightarrow \quad V_{AB} = 10 \text{ V}$$

25. *Ans. (a)*
26. *Ans. (a)*

$$R_{Norton} = 3 + (2 \parallel 6) = 3 + \left(\frac{2\times6}{2+6}\right)$$

$$\Rightarrow \quad 3 + 1.5 = 4.5\ \Omega$$

27. *Ans. (d)*



$$R_{TH} = \frac{120\times(100+68)}{120+100+68} = 70\ \Omega$$

$$V_{TH} = \frac{120}{68+100+120}\times 100$$

$$= 41.6\ V$$

28. ***Ans. (c)***

Since load resistance is constant. So for the maximum power transfer R will be short circuited i.e. R = 0Ω.

$$\therefore \quad \text{Power} = \frac{V^2}{R} = \frac{10\times10}{3}$$

$$= 33.33\ W$$

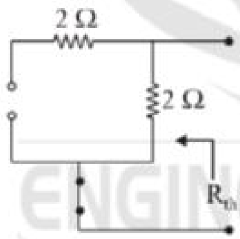
29. ***Ans. (c)***

$$\Rightarrow \quad R_{th} = \frac{10\times6}{10+6} + 3$$

$$= \frac{60}{16} + 3 = 6.75\ \Omega$$

30. ***Ans. (b)***

For R_{th} calculation



$$R_{th} = 2\Omega$$

31. ***Ans. (d)***

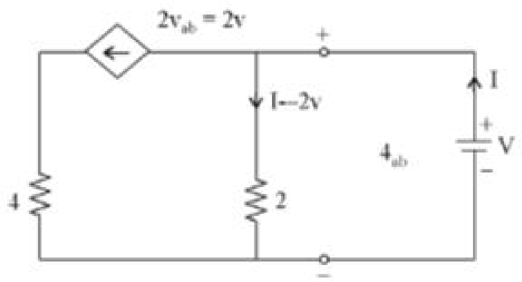
$$R_{AB} = (10 + 20) \parallel (80 + 40)$$

$$= 30 \parallel 120$$

$$= \frac{30\times120}{150}$$

$$= 24\ \Omega$$

32. ***Ans. (b)***



Let assume $V_{ab} = V$

so, $2(I - 2V) = V \Rightarrow 2I - 4V = V$

$\Rightarrow \quad 5V = 2I$

$$\frac{V}{I} = R = \frac{2}{5} = 0 = 0.4\ \Omega$$

33. ***Ans. (d)***

V_{th} = Voltage across 6 Ω resistance

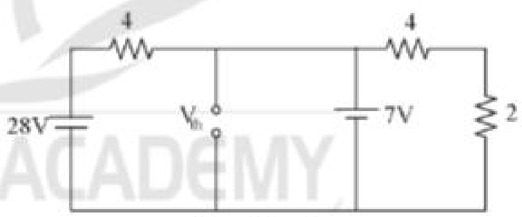
$$= \left(\frac{6}{6+2}\right)10$$

$$= 7.5 \text{ volt}$$

$$R_{th} = 6 \parallel 2$$

$$= 1.5\ \Omega$$

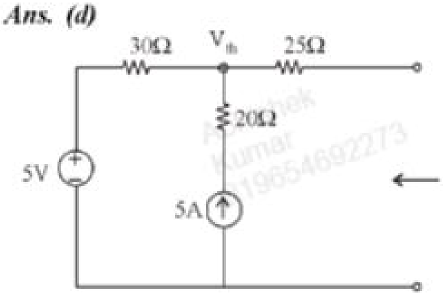
34. ***Ans. (a)***



V_{th} = 7 volt

$R_{th} = 0$

35. ***Ans. (d)***



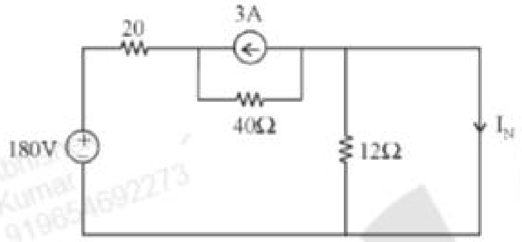
$$\frac{V_{th} - 5}{30} = 5$$

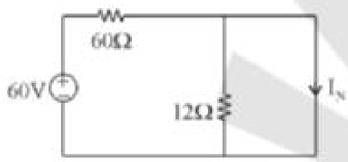
$$\Rightarrow \quad V_{th} = 155 \text{ volt}$$

$$R_{th} = 30 + 25$$

$$= 55\ \Omega$$

36. ***Ans. (a)***

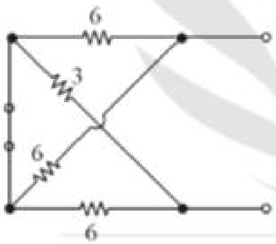


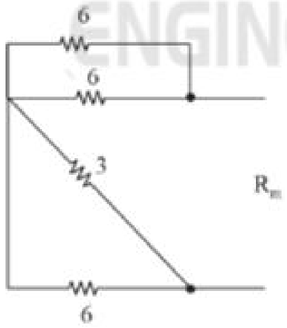


$$I_N = \frac{60}{60}$$

$$I_N = 1 \text{ Amp.}$$

37. ***Ans. (a)***



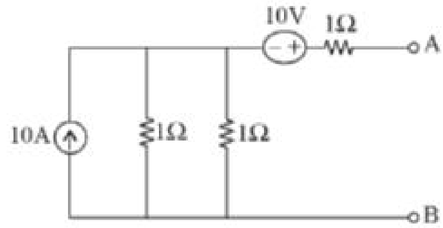


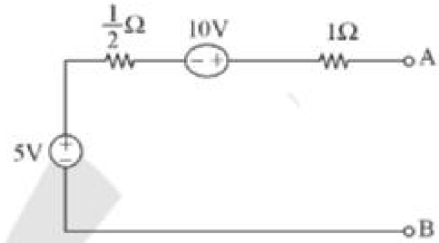
$$R_{th} = (6 \| 6) + (3 \| 6)$$

$$= 3 + 2$$

$$= 5\ \Omega$$

38. ***Ans. (b)***





$$V_{AB} = 15 \text{ volt}$$

39. ***Ans. (b)***

For maximum power transfer

$$R_L = R_{th} = (40 \| 40) + 40 = 60\Omega$$

40. ***Ans. (a)***

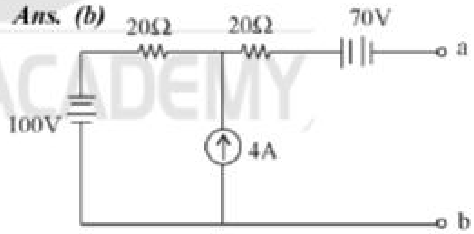
$$I_{rms} = 10 \text{ Amp.}$$

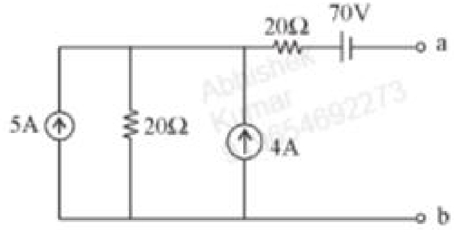
$$\text{Power loss} = I_{rms}^2 R$$

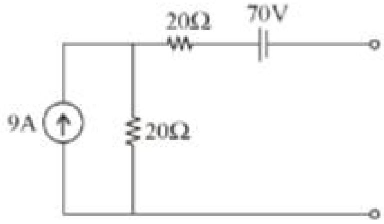
$$= (5)^2\ 10$$

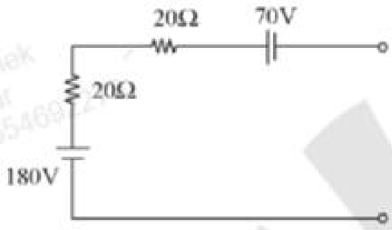
$$= 250 \text{ walt}$$

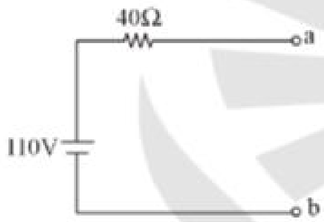
41. ***Ans. (b)***







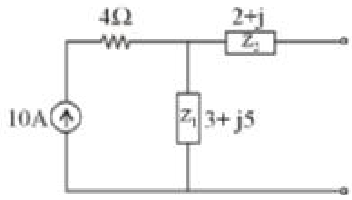




V_{ab} = 110 Volt

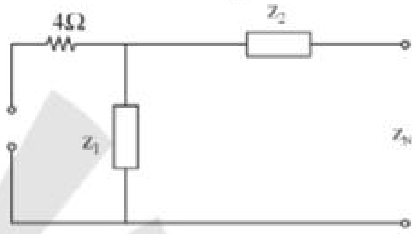
$R_{ab} = 40\Omega$

42. ***Ans. (a)***



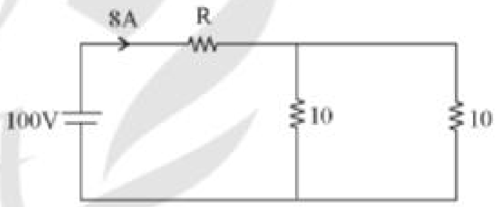
For Z_N :

C.S. → Open Circuit



$$\therefore \quad z_N = z_1 + z_2$$
$$= (3 + j5) + (2 + j)$$
$$= 5 + j6\ \Omega$$

43. ***Ans. (c)***



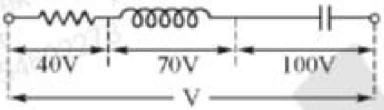
$$100 = 8\ [R + (10 \parallel 10)]$$
$$100 = 8R + 40$$
$$R = 7.5\ \Omega$$

CHAPTER 4

AC CIRCUITS AND RESONANCE

OBJECTIVE QUESTIONS

1. The supply voltage V in circuit given below is



(a) 210 V (b) 70 V

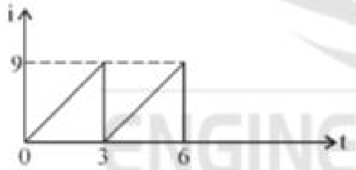
(c) 50 V (d) 230 V

2. An RLC resonant circuit has a resonance frequency of 1.5 MHz and bandwidth of 10 kHz. If C = 150 pF, then the effective resistance of the circuit will be

(a) 29.5 Ω (b) 14.75 Ω

(c) 9.4 Ω (d) 4.7 Ω

3. The current waveform in a pure resistor at 10 Ω is shown in figure Power dissipated in the resistor is



(a) 7.29 W (b) 52.4 W

(c) 135 W (d) 270 W

4. A DC voltage source is connected across a series RLC circuit under steady state conditions. The applied DC voltage drops entirely across the

(a) R only (b) L only

(c) C only (d) R and L combination

5. An RLC series circuit has R = 1 Ω, L = 1 H and C = 1 F, then damping ratio of the circuit will be

(a) more than unity (b) unity

(c) 0.5 (d) zero

6. An RLC series circuit has a resistance R of 20Ω and a current which lags behind the applied voltage by 45°. If the voltage across the inductor is twice the voltage across the capacitor, what is the value of inductive reactance ?

(a) 10Ω (b) 20Ω

(c) 40Ω (d) 60Ω

7. In RLC circuits, the current at resonance is

(a) Maximum in parallel resonance and minimum in series resonance.

(b) Maximum in series resonance and minimum in parallel resonance.

(c) Maximum in both series and parallel resonance.

(d) Minimum in both series and parallel resonance.

8. A parallel RLC circuit resonates at 100 kHz. At frequency of 110 kHz. The circuit impedance will be

(a) Capacitive (b) Inductive

(c) Resistive (d) None of these

9. The ratio of available power from the dc component of a full wave rectified sinusoid to the available power of the rectified sinusoid is

(a) $\frac{8}{\pi}$ (b) $\frac{4\sqrt{2}}{\pi^2}$

(c) $\frac{4\sqrt{2}}{\pi}$ (d) $\frac{8}{\pi^2}$

10. In 220V, 50 Hz AC supply the rms value of AC voltage wave form is

(a) $220\sqrt{2}$ V (b) $\frac{200}{\sqrt{2}}$ V

(c) 220 V (d) None of these

11. For a series RLC circuit, the power factor at the lowest half power frequency is

(a) 0.5 lagging (b) 0.5 leading

(c) unity (d) 0.707 leading

12. For the idealized half wave rectified system the average and rms value of the voltage is

(a) $\frac{V_m}{\pi}, \frac{V_m}{\sqrt{2}}$ respectively

(b) $\frac{V_m}{\pi}, \frac{V_m}{2}$ respectively

(c) $\frac{2V_m}{\pi}, \frac{V_m}{\sqrt{2}}$ respectively

(d) $\frac{2V_m}{\pi}, \frac{V_m}{2}$ respectively

13. The value of current at resonance in a series RLC circuit is governed by

(a) R (b) L

(c) C (d) All of these

14. A particular current is made up of two components a 10A DC and a sinusoidal current of peak value of 14.14A. The average value of resultant current is

(a) Zero (b) 24.14 A

(c) 10 A (d) 14.14 A

15. In a series RLC high circuit the current peaks at a frequency

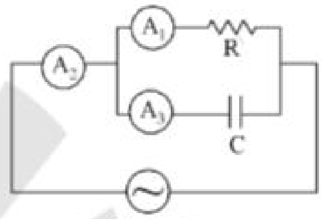
(a) Equal to the resonant frequency

(b) Greater than the resonant frequency

(c) Less than the resonant frequency

(d) None of the above

16. In figure A_1, A_2 and A_3 are ideal ammeters. If A_1 reads 5 A, A_3 reads 12 A, then A_2 should read



(a) 7 A (b) 12 A

(c) 13 A (d) 17 A

17. A series RLC circuit consisting of R = 10 Ω, X_L = 20 Ω and X_C = 20 Ω is connected across an ac supply of 200 V rms. The rms voltage across the capacitor is

(a) $200\angle -90°$V (b) $200\angle 90°$V

(c) $400\angle -90°$V (d) $400\angle 90°$V

18. The current i(t) through a 10Ω resistor in series with an inductance is given by

$i(t) = 3 + 4 \sin(100t + 45°) + 4 \sin(300t + 60°)$

The rms value of the current and the power dissipated in the circuit are

(a) $\sqrt{41}$ A, 410 W

(b) $\sqrt{35}$ A, 350 W

(c) 5 A, 250 W

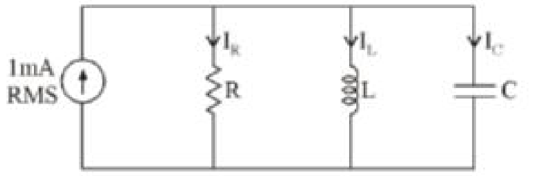
(d) 11 A, 1210 W

19. A series RLC circuit has a Q of 100 and an impedance of (100 + j0) Ω at its resonant angular frequency of 10^7 rad/sec. The values of R and L are

(a) 100 Ω, 10^3 H (b) 100 Ω, 10^{-3} H

(c) 10 Ω, 10 H (d) 10 Ω, 0.1 H

20. The parallel RLC circuit shown in figure is in resonance. In this circuit



(a) $|I_R| < 1$ mA (b) $|I_R + I_L| > 1$ mA

(c) $|I_R + I_C| < 1$ mA (d) $|I_R + I_L| < 1$ mA

21. A series RLC circuit has a resonance frequency of 1 kHz and a quality factor Q of 100. If each of R, L and C is doubled from its original value, the new Q of the circuit is

(a) 25 (b) 50

(c) 100 (d) 200

22. An input voltage

$v(t) = 10\sqrt{2}\cos(t + 10°) + 10\sqrt{3}\cos(2t + 10°)$

is applied to a series combination of R = 1Ω and L = 1H. The resulting steady state current I(t) in ampere is

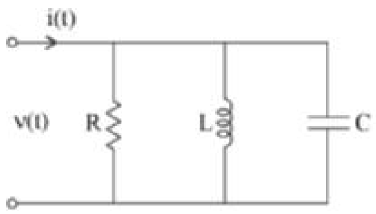
(a) $10\cos(t+55°) + 10\cos(2t+10°+\tan^{-1} 2)$

(b) $10\cos(t+55°) + 10\sqrt{\frac{3}{2}}\cos(2t + 55°)$

(c) $10\cos(t-35°) + 10\sqrt{\frac{3}{5}}\cos(2t+10°-\tan^{-1}2)$

(d) $10\cos(t - 35°) + 10\sqrt{\frac{3}{2}}\cos(2t - 35°)$

23. The circuit shown in figure with $R = \frac{1}{3}\Omega$, $L = \frac{1}{4}$H and C = 3F has input voltage v(t) = sin 2t. The resulting current i(t) is



(a) 5 sin (2t + 53.1°) (b) 5 sin (2t − 53.1°)

(c) 25 sin (2t + 53.1°) (d) 25 sin (2t − 53.1°)

24. In a series RLC circuit, R = 2 kΩ, L = 1 H and $C = \frac{1}{400}\mu F$. The resonant frequency is

(a) 2×10^4 Hz (b) $\frac{1}{\pi} \times 10^4$ Hz

(c) 10^4 Hz (d) $2\pi \times 10^4$ Hz

25. For a series resonant circuit at low frequency, circuit impedance is and at high frequency circuit impedance is

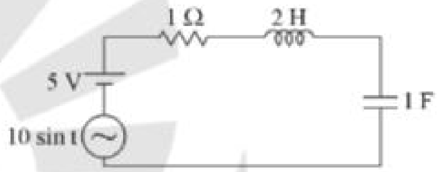
(a) Capacitive, inductive

(b) Inductive, capacitive

(c) Resistive, inductive

(d) Capacitive, resistive

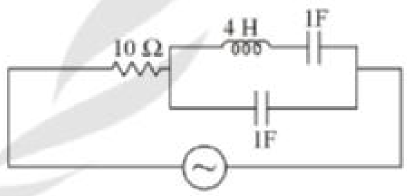
26. In given circuit i(t) under steady state is



(a) Zero (b) 5

(c) 7.07 sin t (d) 7.07 sin (t − 45°)

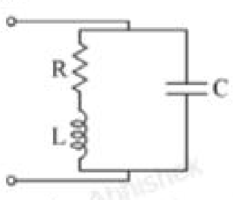
27. The following circuit in figure resonates at



(a) All frequencies (b) 5 rad/s

(c) 0.5 rad/s (d) 1 rad/s

28. At resonance, the parallel circuit shown in figure behaves like



(a) An open circuit

(b) A short circuit

(c) A pure resistor of value R

(d) A pure resistor of value much higher than R

29. A circuit with a resistor, inductor and capacitor in series is resonant of f_0 Hz. If all the component values are now doubled, the new resonant frequency is

(a) $2f_0$ (b) f_0

(c) $\frac{f_0}{4}$ (d) $\frac{f_0}{2}$

30. In a series RLC circuit at resonance, the magnitude of the voltage developed across the capacitor

(a) Is always zero

(b) Can never be greater than the input voltage

(c) Can be greater than the input voltage, however it is 90° out of phase with the input voltage

(d) Can be greater than the input voltage and is in phase with the input voltage

31. A 240 V, single-phase AC source is connected to a load with an impedance of $10\angle 60°\Omega$. A capacitor is connected in parallel with the load. If the capacitor supplies 1250 VAR, the real power supplied by the source is

(a) 3600 W (b) 2880 W

(c) 2400 W (d) 1200 W

32. The power in a series RLC circuit will be half of that at resonance when the magnitude of the current is equal to

(a) $\frac{V}{2R}$ (b) $\frac{V}{\sqrt{3}R}$

(c) $\frac{V}{\sqrt{2}R}$ (d) $\frac{\sqrt{2}V}{R}$

33. If a network has an impedance of $(1 - j)$ at a specific frequency, the circuit would consists of series

1. R and C 2. R and L

3. R, L and C

Which of these statements are correct?

(a) 1 and 2 (b) 1 and 3

(c) 1, 2 and 3 (d) 2 and 3

34. A series RLC circuit resonance at 1 MHz at frequency of 1.1 MHz the circuit impedance is

(a) Capacitive (b) Inductive

(c) Resistive (d) None of these

35. For the parallel RLC circuit to be overdamped.

(a) $R < 2\sqrt{\frac{L}{C}}$ (b) $R > 2\sqrt{\frac{L}{C}}$

(c) $R < \frac{1}{2}\sqrt{\frac{L}{C}}$ (d) $R > \frac{1}{2}\sqrt{\frac{L}{C}}$

36. A series resonant circuit has an inductive reactance of 1000Ω, a capacitive reactance of 1000Ω, and a resistance of 0.1Ω. If the resonant frequency is 10MHz, then the bandwidth of the circuit will be

(a) 1 kHz (b) 10 kHz

(c) 1 MHz (d) 0.1 kHz

37. In an RLC parallel circuit the impedance at resonance is

(a) Maximum (b) Minimum

(c) Zero (d) Infinity

38. If the resistance in a series RC circuit is increased, the magnitude of the phase

(a) Increases

(b) Remains the same

(c) Decreases

(d) Changes in an indeterminate manner

39. On increasing the 'Q' of the coil

(a) Its power factor increases

(b) Its power factor decreases

(c) Its power factor remains unaltered

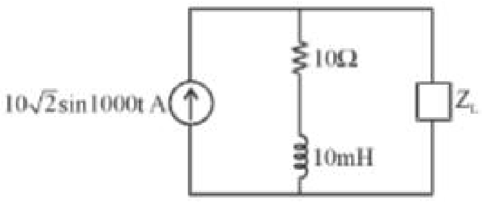
(d) Its power may increase of decreases

40. A water boiler at home is switched on to the AC mains supplying power at 230 V, 50 Hz. The frequency of instantaneous power consumed by the boiler is

(a) 0 Hz (b) 50 Hz

(c) 100 Hz (d) 150 Hz

41. In the circuit shown below the maximum power that can be transferred to the load Z_L is



(a) 250 W (b) 500 W
(c) 1000 W (d) 2000 W

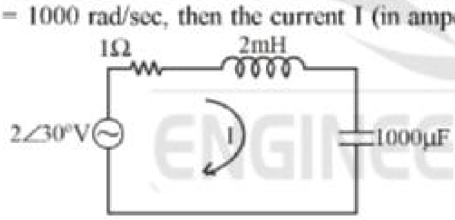
42. In a parallel RLC circuit the critical resistance with L = 8 H and C = 2 F is given by

(a) $\frac{1}{2}$ Ω (b) 1Ω
(c) 2 Ω (d) 3 Ω

43. The current i in a series RL circuit with R = 10Ω and L = 20 mH is given by i = 2 sin 500t A. If V is the voltage across the RL combination then i

(a) lags V by 45°
(b) is in phase with V
(c) leads V by 45°
(d) lags V by 90°

44. For the series RLC circuit in given figure, if ω = 1000 rad/sec, then the current I (in ampere) is

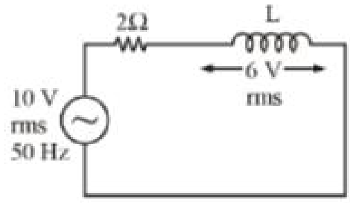


(a) $2\angle-15^\circ$ (b) $2\angle15^\circ$
(c) $\sqrt{2}\angle-15^\circ$ (d) $\sqrt{2}\angle15^\circ$

45. The input impedance of a series RLC circuit operating at frequency $\omega = \sqrt{2}\,\omega_0$, ω_0 being the resonant frequency, is

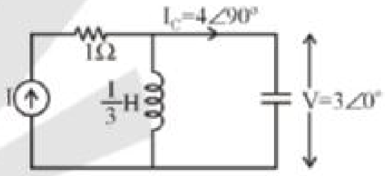
(a) $\left(R-j\frac{\omega_0 L}{\sqrt{2}}\right)\Omega$ (b) $\left(R+j\frac{\omega_0 L}{\sqrt{2}}\right)\Omega$
(c) $\left(R-j\sqrt{2}\omega_0 L\right)\Omega$ (d) $\left(R+j\sqrt{2}\omega_0 L\right)\Omega$

46. The rms value of the current in the ac circuit as shown in the below figure is



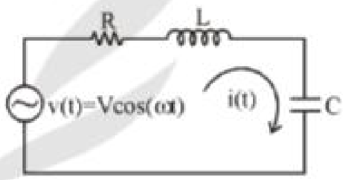
(a) 2A (b) 4A
(c) 5A (d) 8A

47. For the given circuit, ω = 3 rad/s. If V is taken as reference, the phasor of I is given by



(a) $1\angle90^\circ$ (b) $3\angle90^\circ$
(c) $5\angle60^\circ$ (d) $\sqrt{2}\angle-45^\circ$

48. If the steady state current in the circuit given in the figure is i(t) = Icos(ωt + φ), then



The value of φ will be

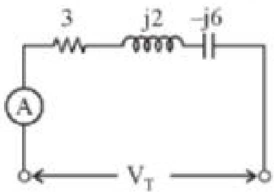
(a) $-\tan^{-1}\left[\frac{\omega L-\frac{1}{\omega C}}{R}\right]$

(b) $\tan^{-1}\left[\frac{R}{\omega L-\frac{1}{\omega C}}\right]$

(c) $\tan^{-1}\sqrt{\frac{L}{C}}$

(d) $\tan^{-1}\sqrt{\frac{R}{LC}}$

49. In the AC circuit shown in the given figure when the ammeter reads 10A, the readings on a voltmeter placed across the entire circuit and then across each element are given below.



Match List-I (position of the voltmeter) with List-II (readings on the voltmeter) and select the correct answer using the codes given below

List-I		List-II
A. V_T	**1.**	60
B. V_R	**2.**	20
C. V_L	**3.**	30
D. V_C	**4.**	50
	5.	110

Codes:	**A**	**B**	**C**	**D**
(a)	5	4	2	1
(b)	5	3	1	2
(c)	4	5	1	2
(d)	4	3	2	1

50. The value of R, L and C in series RLC circuit that resonates at 1.5 kHz and consumes 50W from a 50 V ac source operating at the resonant frequency. The bandwidth is 0.75 kHz

(a) R = 50 Ω, L = 10.6 mH, C = 1.06 μF

(b) R = 500 Ω, L = 10.6 mH, C = 10.6 μF

(c) R = 50 Ω, L = 1.06 mH, C = 10.6 μF

(d) R = 500 Ω, L = 1.06 mH, C = 1.06 μF

51. A coil has self resistance of 5Ω and inductance of 1 μH. The value of Q at 1 MHz frequency is

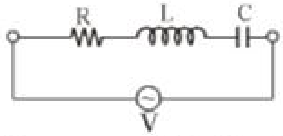
(a) 200

(b) 100

(c) 40

(d) None of these

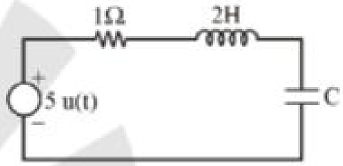
52. The Q of RLC tuned circuit with source voltage V in the figure is 100 at resonant frequency of 100 kHz. What is the voltage V_L across inductor at resonance?



(a) 50 V (b) $V_L - V_C$

(c) 100 V (d) $V_R - V_C$

53. The value of C which gives the critical damping in the given circuit is



(a) 2 F (b) 4 F

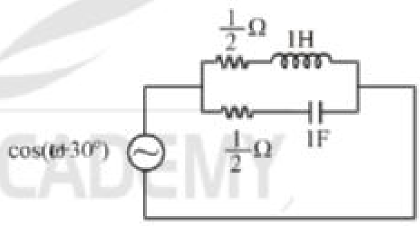
(c) 8 F (d) 1 F

54. A series RLC circuit resonates at 3 MHz and has 3-dB bandwidth of 10 kHz. The Q of the circuit at resonance

(a) 30 (b) $\frac{300}{\sqrt{2}}$

(c) 300 (d) $300\sqrt{2}$

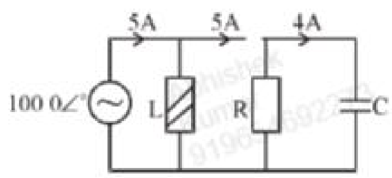
55. The average power dissipated in the circuit at resonance is



(a) 0 W (b) 1 W

(c) 2 W (d) 4 W

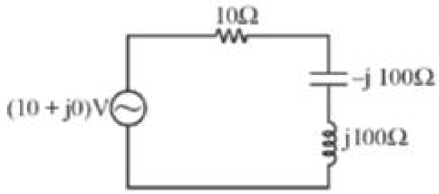
56. The power factor of the circuit shown in figure is.



(a) 0.8 (lag) (b) 0.8 (lead)

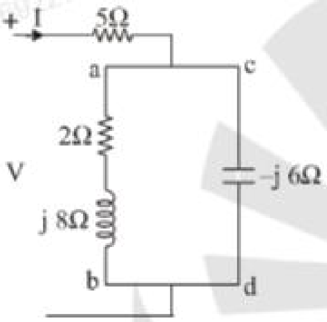
(c) 0.6 (lag) (d) 0.6 (lead)

57. For the circuit shown below the 'Q' factor is.



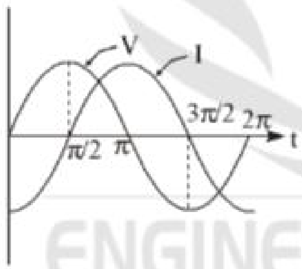
(a) 1 (b) 5
(c) 10 (d) 20

58. Consider the following circuit and determine the power loss in resistor of branch 'ab'. (Given : supply voltage = 220V)



(a) 1000 W (b) 2300 W
(c) 1040 W (d) 5674 W

59. The wave forms shown below indicate:



(a) V lags I by π (b) V leads I by π

(c) V lags I by $\frac{\pi}{2}$ (d) V leads I by $\frac{\pi}{2}$

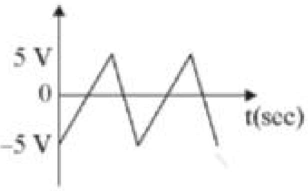
60. The parallel circuit consists of an inductive branch with R and L as its resistance and inductance, and a capacitance branch with C farad. The impedance offered "by this circuit under resonance condition is given by:

(a) Z = LCR (b) Z = R/LC
(c) Z = L/CR (d) Z = LC/R

61. In an RLC series circuit the condition below the resonant frequency is:

(a) $X_C > X_L$ (b) $X_C + X_L$
(c) $X_C < X_L$ (d) $X_C = X_L$

62. The V_{rms} value of the given wave is

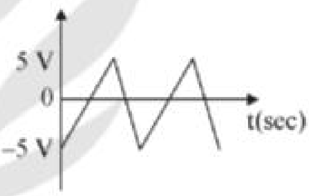


(a) 2.88 V (b) 3.53 V
(c) 5 V (d) 10 V

63. In a series RC circuit the voltage across a pure capacitor is 12V and the voltage across a pure resistance is 5V. Find the source voltage _____.

(a) 13 V (b) 17 V
(c) 7 V (d) 2.7 V

64. What is the peak to peak of the following waves?



(a) –5 V (b) 10 V
(c) 9 V (d) 5 V

65. What is the resonance frequency ω_0 in a series RLC circuit with R = 1Ω, L = 1 and C = 1/4 F?

(a) 2√(3/4)Hz (b) 2√(3/4)rad/s
(c) 2rad/s (d) 2Hz

66. In RLC series circuit, frequency at resonance is

(a) $f_r = \frac{1}{\pi\sqrt{LC}}$ (b) $f_r = 2\pi\sqrt{LC}$

(c) $f_r = \frac{R}{2\pi\sqrt{LC}}$ (d) $f_r = \frac{1}{2\pi\sqrt{LC}}$

67. Q - factor is defined as the ratio of

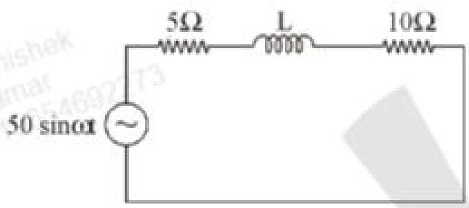
(a) Resistance / inductance of reactive

(b) Resistance / capacitance of reactive element

(c) Reactance of reactive element to Resistance

(d) Resistance to susceptance of reactive element

68. In the circuit shown in the figure, if the power consumed by the 5Ω resistor are 10 W, then the power factor of the circuit is



(a) 0.8 (b) 0.5

(c) 0.6 (d) 0

69. $\sqrt{\frac{L}{C}}$ has its units as–

(a) Hz (b) ohm

(c) s (d) rad/s

❑❑❑

ANSWER KEY

1. *Ans. (c)*

Voltage across inductor and capacitor will be in opposite direction. So, net voltage will be 30 V which will be 90° displaced from voltage across resistance.

So, $$V = \sqrt{(40)^2 + (30)^2} = 50 \text{ V}$$

2. *Ans. (d)*

Resonance frequency,

$$f_0 = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

And bandwidth

$$f_2 - f_1 = \frac{1}{2\pi}\frac{R}{L}$$

$$\frac{f_2 - f_1}{f_0^2} = \frac{1}{2\pi}\frac{R}{L} \times LC \times (2\pi)^2$$

$$\Rightarrow \quad R = \frac{f_2 - f_1}{2\pi f_0^2 C} = 4.7\Omega$$

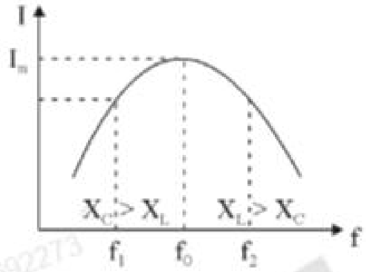
3. *Ans. (d)*
4. *Ans. (c)*
5. *Ans. (c)*
6. *Ans. (c)*
7. *Ans. (b)*
8. *Ans. (a)*
9. *Ans. (d)*
10. *Ans. (c)*
11. *Ans. (d)*
12. *Ans. (b)*
13. *Ans. (a)*
14. *Ans. (c)*
15. *Ans. (a)*
16. *Ans. (c)*
17. *Ans. (c)*
18. *Ans. (c)*
19. *Ans. (b)*
20. *Ans. (b)*
21. *Ans. (d)*
22. *Ans. (c)*
23. *Ans. (a)*
24. *Ans. (b)*
25. *Ans. (a)*
26. *Ans. (d)*
27. *Ans. (c)*
28. *Ans. (d)*
29. *Ans. (d)*
30. *Ans. (c)*
31. *Ans. (b)*
32. *Ans. (c)*
33. *Ans. (b)*
34. *Ans. (b)*
35. *Ans. (c)*
36. *Ans. (a)*
37. *Ans. (a)*
38. *Ans. (c)*
39. *Ans. (b)*
40. *Ans. (c)*
41. *Ans. (b)*
42. *Ans. (b)*
43. *Ans. (a)*
44. *Ans. (c)*
45. *Ans. (b)*
46. *Ans. (b)*
47. *Ans. (a)*
48. *Ans. (a)*
49. *Ans. (d)*
50. *Ans. (a)*
51. *Ans. (d)*
52. *Ans. (c)*
53. *Ans. (c)*
54. *Ans. (c)*
55. *Ans. (b)*
56. *Ans. (c)*
57. *Ans. (c)*
58. *Ans. (c)*
59. *Ans. (d)*
60. *Ans. (c)*

This is tank circuit.

$$\therefore \quad Z = L/CR$$

61. *Ans. (a)*

In series RLC circuit below the resonant frequency power factor is leading. So, capacitance is dominant.



62. *Ans. (a)*

$$V_{rms} = \frac{V_m}{\sqrt{3}}$$

$$= \frac{5}{\sqrt{3}} = 2.88\ V$$

63. *Ans. (a)*

$$V_S = \sqrt{V_R^2 + V_C^2}$$

$$= \sqrt{5^2 + 12^2} = 13V$$

64. *Ans. (b)*

Peak to Peak Voltage (V_{PP})

$$= V_m - (-V_m)$$

$$= 2V_m = 2 \times 5 = 10V$$

65. *Ans. (c)*

$$\omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{1 \times \frac{1}{4}}}$$

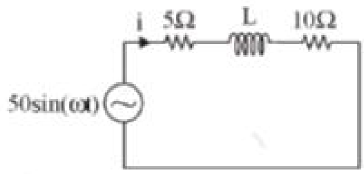
$$= 2\ \text{rad/sec}$$

66. *Ans. (d)*

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

67. *Ans. (c)*

68. *Ans. (c)*



$\because$ Consumed power in R is 10 W

$$\Rightarrow \quad I_{rms}R = 10$$

$$\Rightarrow \quad I_{rms} = \sqrt{\frac{10}{5}}$$

$$I_{rms} = \sqrt{2}$$

Now $\quad \cos\phi = \frac{P}{S} = \frac{I^2R}{VI} = \frac{IR}{V}$

$$\therefore \quad \cos\phi = \frac{I_{rms}R}{V_{rms}} = \frac{12 \times 15}{\left(\frac{50}{\sqrt{2}}\right)}$$

$$= 0.6$$

69. *Ans. (b)*

$$\sqrt{\frac{L}{C}} \rightarrow \text{ohm}$$

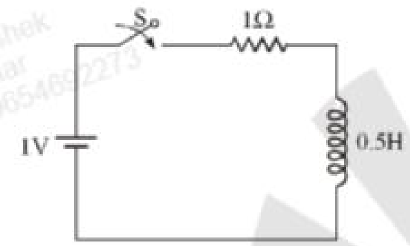
❑❑❑

CHAPTER 5

TRANSIENT RESPONSE

OBJECTIVE QUESTIONS

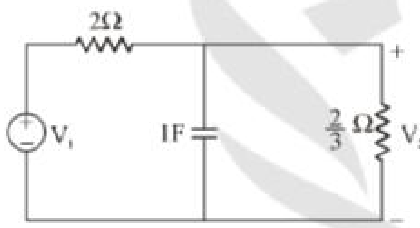
1. Steady state value of the current in the circuit



(a) 0 (b) $\frac{1}{2}$

(c) 2 (d) 1

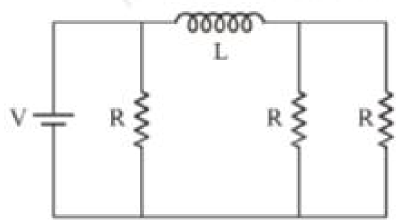
2. If $V_2 = 1 - e^{-2t}$, then value of V_1 is given by



(a) 4 (b) $3 + e^{-2t}$

(c) $1 + 3e^{-2t}$ (d) $4 - 2e^{-2t}$

3. In the network given below. The time constant of the circuit is



(a) $\frac{L}{2R}$ (b) $\frac{2L}{R}$

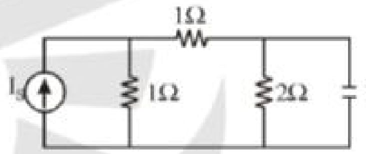
(c) $\frac{L}{3R}$ (d) $\frac{3L}{R}$

4. The current through a series RL circuit is $\frac{1}{4}e^{-\frac{1}{2}t}$ when exited by a unit impulse voltage. The value of R and L are respectively

(a) 8, 4 (b) 4, 2

(c) 2, 4 (d) 1, 4

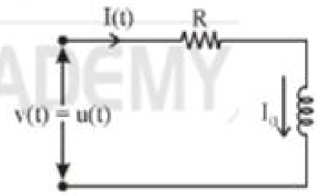
5. For the circuit shown in the given figure, the time constant of the basic circuit is



(a) $\frac{2}{3}$ sec (b) 1 sec

(c) 2 sec (d) 3 sec

6. In the RL circuit shown in the given figure, the inductor is carrying current I_0. At time t = 0 a unit step input is applied. Then the current i(t) at t = τ is given by



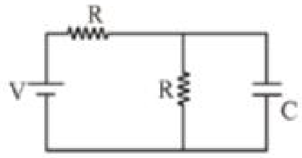
(a) $\frac{0.632}{R}$

(b) $0.632\ I_0$

(c) $\frac{0.632}{R} + 0.368\ I_0$

(d) $0.632\left(I_0 + \frac{1}{R}\right)$

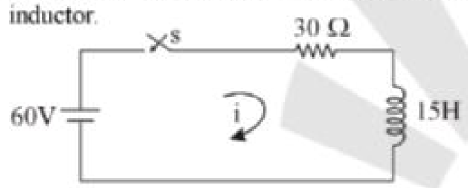
7. A circuit consisting of two resistor a capacitor and a battery as shown in figure. In the steady state, the voltage across the capacitor would be



(a) Zero Volts (b) V Volts

(c) Infinite values (d) $\frac{V}{2}$ Volts

8. A series RL circuit (as shown in fig.) has a constant voltage V = 60V applied at t = 0. Determine the current flowing through the inductor.



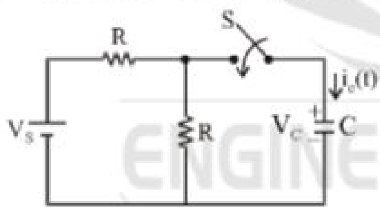
(a) $(1 - e^{-2t})$

(b) $2(1 - e^{-2t})$

(c) $2(e^{2t})$

(d) e^{-2t}

9. In the circuit in given figure, the switch S is closed at t = 0. Assuming that there is no initial charge in the capacitor, the current $i_c(t)$ for t > 0



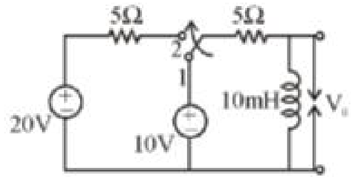
(a) $\frac{V_s}{R}e^{-\frac{2t}{RC}}A$

(b) $\frac{V_s}{R}e^{-\frac{t}{RC}}A$

(c) $\frac{V_s}{2R}e^{-\frac{2t}{RC}}A$

(d) $\frac{V_s}{2R}e^{-\frac{t}{RC}}A$

10. The switch shown in figure is ideal and has been in position 1 for t < 0



If the switch is moved to position 2 at t = 0, then V_o for t > 0 is given by

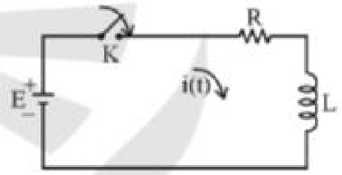
(a) 0 V

(b) $2 + 2(1 + e^{-1000t})$V

(c) $2 + (1 - e^{-1000t})$V

(d) $2e^{-1000t}$V

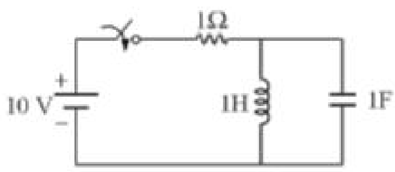
11. The correct value of the current i(t) at any instant when K is switched on at t = 0 in the network shown in the given figure is



(a) $\frac{E}{R}+\frac{E}{R}e^{\left(\frac{R}{L}\right)}$ (b) $\frac{E}{R}-\frac{E}{R}e^{\left(\frac{R}{L}\right)}$

(c) $\frac{E}{R}+\frac{E}{R}e^{-\left(\frac{R}{L}\right)}$ (d) $\frac{E}{R}-\frac{E}{R}e^{-\left(\frac{R}{L}\right)}$

12. The switch in the given circuit is closed at t = 0. The current through the battery at t = 0, and t = 0^+ is, respectively



(a) 10 A and 10 A

(b) 0 A and 10 A

(c) 10 A and 0 A

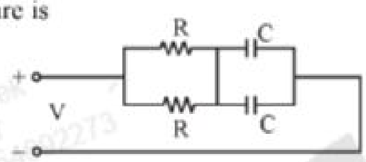
(d) 0 A and 0 A

13. A dc voltage V is applied to a series RL circuit. The steady state current is

(a) $\frac{V}{R}$ (b) $\frac{V}{L}$

(c) $\frac{V}{\sqrt{R^2+L^2}}$ (d) Zero

14. The time-constant of the network shown in the figure is



(a) CR (b) 2CR

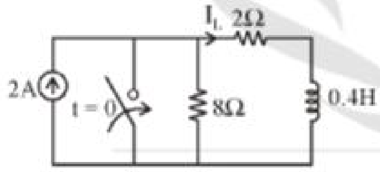
(c) $\frac{CR}{4}$ (d) $\frac{CR}{2}$

15. Time constant of a series RL circuit equals

(a) $\frac{L}{R}$ (b) LR

(c) L^2R (d) LR^2

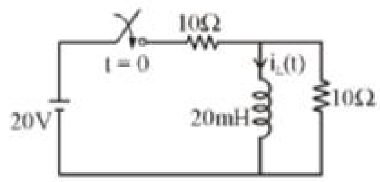
16. In the circuit shown in figure, the switch closes at t = 0. Assuming steady state condition for $t = 0^-$, the current I_L at t = 0.15 sec is (approximately)



(a) 0.04 A (b) 0.5 A

(c) 0.76 A (d) 1.60 A

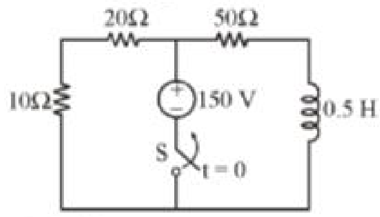
17. For the circuit shown in figure, if the initial inductor current is 2A, then $i_L(t)$ at t = 40 ms is



(a) 0.5 A (b) 1 A

(c) 2 A (d) 3 A

18. For the circuit shown in figure, the switch is closed for a long time and it is opening at t = 0. The current through the 50Ω resistor is



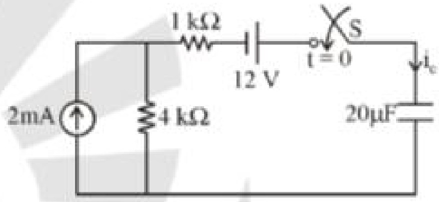
(a) $3e^{-t}/160$

(b) $3e^{-t/100}$

(c) $3e^{-100t}$

(d) $3e^{-160t}$

19. Consider the following network

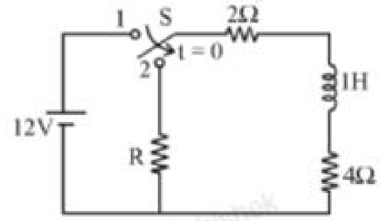


The switch is closed at t = 0. The current through the capacitor at t = 100 ms is

(a) 0 mA (b) $\frac{4}{5e}$mA

(c) $\frac{12}{5e}$mA (d) $\frac{4}{e}$mA

20. A coil of inductance 1H and resistance 4Ω is connected as shown in figure. The switch 'S' is in position 1 for a long time and it is moved to position 2 at t = 0

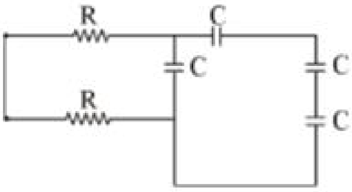


If at $t = 0^+$ the voltage across the coil is 12 V, the value of resistance R is

(a) 0 Ω (b) 2 Ω

(c) 4 Ω (d) 6 Ω

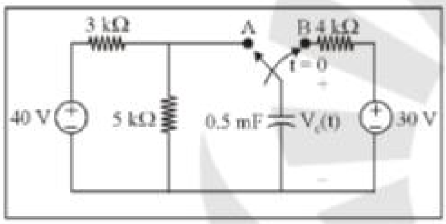
21. The time constant of the circuit shown in fig. is:



(a) RC/3 (b) 4RC/3

(c) 2RC/3 (d) 8RC/3

22. For the circuit shown in the figure below, the switch has been in the position A for a long time. At t = 0, the switch has moved to B. Then, what will be the value of capacitor Voltage V_c for t > 0 ?



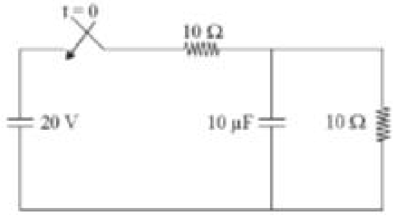
(a) $V_c(t) = (24 - 6e^{-2t})$ V

(b) $V_c(t) = (30 - 5e^{-0.5t})$ V

(c) $V_c(t) = (6 - 6^{-2t})$ V

(d) $V_c(t) = (24 - 5e^{-2t})$ V

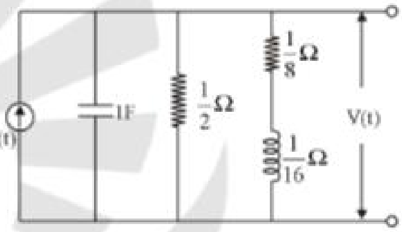
23. In the figure given below, the initial capacitor voltage is zero. Then after switch is closes at t = 0, Calculate the final steady state voltage across the capacitor



(a) 20 V (b) 10 V

(c) 5 V (d) 0 V

24. Consider the following given figure and calcualte steady-state value of v(t) if i(t) is a unit step current.



(a) 2.5 V (b) 1 V

(c) 0.1 V (d) 0

25. By which of the following elements transients will not occur?

(a) L (b) R

(c) C (d) All of these

□□□

Answer Key

1. *Ans. (d)*
2. *Ans. (a)*
3. *Ans. (b)*
4. *Ans. (c)*
5. *Ans. (b)*
6. *Ans. (c)*
7. *Ans. (d)*
8. *Ans. (b)*

$$I = \frac{V}{R}[1 - e^{-t/\tau}]$$

$$\tau = \frac{L}{R} = \frac{15}{30} = \frac{1}{2}$$

$$I = 2[1 - e^{-2t}]$$

9. *Ans. (a)*
10. *Ans. (a)*
11. *Ans. (d)*
12. *Ans. (a)*
13. *Ans. (a)*
14. *Ans. (a)*
15. *Ans. (a)*
16. *Ans. (c)*
17. *Ans. (c)*
18. *Ans. (d)*
19. *Ans. (d)*
20. *Ans. (a)*
21. *Ans. (d)*

$$C_{eq} = \frac{C}{3} + C = \frac{4C}{3}$$

$$R_{eq} = 2R$$

$$T = R_{eq}C_{eq}$$

$$= \frac{8RC}{3}$$

22. *Ans. (b)*

At Position A:

$$V_C(o^+) = \left(\frac{40}{3+5}\right)5 = 25 \text{ volt}$$

$$V_C(\infty) = 30 \text{ volt}$$

At Position B:

$$V_C(t) = V_C(\infty) + \left[\left(V_C(o^+) - V_C(\infty)\right)e^{-t/T}\right]$$

$$= 30 + \left[(25 - 30)e^{-t/T}\right]$$

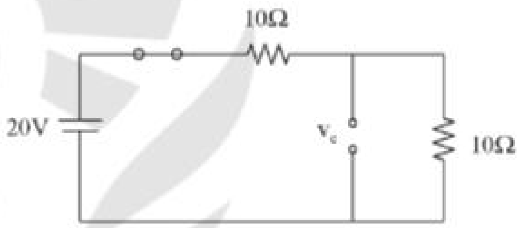
$$= 30 - 5e^{-t/T}$$

Time constant $T = Rc = 4\times10^3\times0.5\times10^{-3}$

$$= 2 \text{ se}$$

$\therefore$ $V_C(t) = 30 - 5\,e^{-t/2}$

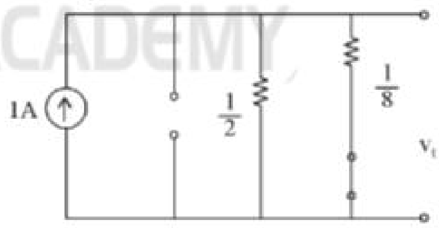
23. *Ans. (b)*



$$V_C(o^-) = \left(\frac{10}{10+10}\right)20 = 10 \text{ volt}$$

24. *Ans. (c)*

At steady state condition



$$y_t = \left(\frac{1}{2}\,\middle\|\,\frac{1}{8}\right)\times 1$$

$$= \frac{1}{10} = 0.1 \text{ volt}$$

25. *Ans. (b)*

CHAPTER 6

POWER ELECTRONICS

OBJECTIVE QUESTIONS

1. Match List-I (Converters) with List-II (Type of Conversion) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Controlled Rectifier	**1.** Fixed DC to variable voltage and variable frequency AC
B. Chopper	**2.** Fixed DC to variable DC
C. Inverter	**3.** Fixed AC to variable DC
D. Cycloconverter	**4.** Fixed AC to variable frequency AC

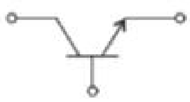
Codes:	A	B	C	D
(a)	2	3	1	4
(b)	3	2	4	1
(c)	2	3	4	1
(d)	3	2	1	4

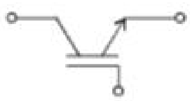
2. Match List-I (Power Electronic Devices) with List-II (Symbols) and select the correct answer using the codes given below the lists:

List-I **List-II**

A. GTO thyristor **1.** 

B. TRIAC **2.** 

C. IGBT **3.** 

D. BJT **4.** 

Codes:	A	B	C	D
(a)	1	2	3	4
(b)	1	2	4	3
(c)	2	1	3	4
(d)	2	1	4	3

3. A gate-tum-off (GTO) thyristor
(a) requires a special turn-off circuit like a thyristor
(b) can be turned off by removing the gate pulse
(c) can be turned off by a negative current pulse at the gate
(d) can be turned off by a positive current pulse at the gate

4. The on-stage voltage of a GTO is
(a) 0.7 V (b) 1-2 V
(c) 2-3 V (d) >3

5. Which one of the following statement is TRUE for an 'ideal' power diode?
(a) Forward voltage drop is zero and reverse saturation current is non zero
(b) Reverse recovery time is non-zero and reverse saturation current is zero
(c) Forward voltage drop is zero and reverse recovery time is zero
(d) Forward voltage drop is non-zero and reverse recovery time is zero

6. Which one of the following diodes contains a metal-semiconductor junction?
(a) Tunnel diode (b) Zener diode
(c) Schottky diode (d) Gunn diode

7. Which of them is a disadvantage of power converters over conventional switch.
   (a) High efficiency
   (b) small weight and good packaging
   (c) high Reliability
   (d) regeneration process is not easy .

8. Which of them is not characteristic of Ideal switch.
   (a) Infinite current conduction capacity
   (b) Zero on state voltage drop
   (c) Infinite voltage blocking capacity
   (d) Zero off state resistance

9. Which of them is not a fully controlled device
   (a) Power MOSFET (b) IGBT.
   (c) SCR. (d) GTO

10. Which one of them do not need continuous gate signal for triggering.
   (a) MOSFET (b) IGBT
   (c) SIT (d) GTO

11. Which of the device do not have control terminal.
   (a) SCR (b) Power diode
   (c) Power BJT (d) IGBT

12. On Increasing N^- layer in power diode
   (a) switching speed decreases
   (b) conduction loss decreases
   (c) efficiency of device increases
   (d) None of these.

13. ON state voltage drop of power diode is
   (a) 0.7 V (b) 0.3 V
   (c) 1 V (d) 0.5 V

14. Which of these diodes have least turn on time:
   (a) general purpose diode
   (b) Fast recovery diode
   (c) Schottky diode
   (d) Diode used in rectifiers

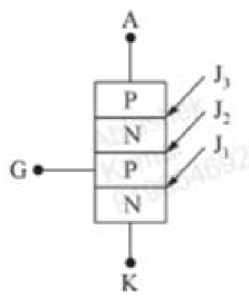
15. Which of the diode do not have a depletion layer in it
   (a) Schottky diode
   (b) general purpose diode
   (c) fast recovery diode
   (d) None of these

16. For a Ideal diode
   (a) reverse recovery time should be less
   (b) reverse recovery time should be 0
   (c) softness factor must be 0.
   (d) softness factor must be 1.

17. Which of the relation is correct for reverse recovery of diode
   (a) $I_{RM} = \left[\frac{Qrr}{di/dt}\right]^{\frac{1}{2}}$ (b) $I_{RM} = \left[\frac{2.Qrr}{di/dt}\right]^{\frac{1}{2}}$
   (c) $I_{RM} = \left[\frac{Qrr}{2di/dt}\right]^{\frac{1}{2}}$ (d) None of these

18. Peak inverse current and reverse recovery time depends on
   (a) Stored charge, $\frac{di}{dt}$ of forward current
   (b) Stored charge
   (c) $\frac{di}{dt}$ of forward current
   (d) None of these

19. Figure shown a thyristor with the standard terminations of anode (A), cathode (K), gate (G) and the different junctions named J_1, J_2 and J_3. When anode to cathode voltage is positive and SCR is about to conduct load current.



(a) J_1 and J_2 are forward biased and J_3 is reverse biased.

(b) J_1 and J_3 are forward biased and J_2 is reverse biased.

(c) J_1 is forward biased and J_2 and J_3 are reverse biased.

(d) J_1, J_2 and J_3 are all forward biased.

20. The main reason for connecting a pulse transformer at a output stage of a thyristor triggering circuit is to

(a) amplify the power of the triggering pulse

(b) provide electrical isolation

(c) reduce the turn-on time of the thyristor

(d) avoid spurious triggering of the thyristor due to noise

21. Turn-on and turn-off times of transistor depend on

(a) Static characteristic

(b) Junction capacitances

(c) Current gain

(d) None of the above

22. Which one of the following statements is correct? The turn off times of converter grade SCRs are normally in the range of

(a) 1 to 2 microseconds

(b) 50 to 200 microseconds

(c) 500 to 1000 microseconds

(d) 1 to 2 milliseconds

23. Which one of the following statements is correct? For an SCR dv/dt protection is achieved through the use of

(a) RL in series with SCR

(b) RC across SCR

(c) L in series with SCR

(d) RC in series with SCR

24. In the case of a thyristor, di/dt capability can be improved by

(a) thermal triggering (b) voltage triggering

(c) dv/dt triggering (d) gate pulse triggering

25. If the amplitude of the gate pulse to thyristor is increased then

(a) both delay time and rise time would increase.

(b) the delay time would increase but the rise time would decrease.

(c) the delay time would decrease but the rise time would increase.

(d) the delay time would decrease while the rise time remains unaffected.

26. In order to obtain static voltage equalization in series-connected SCRs connections are made of

(a) one resistor across the string

(b) resistors of different values across each SCR

(c) resistors of the same value across each SCR

(d) one resistor in series with the string

27. It is preferable to use a train of pulse of high frequency for gate triggering of SCR in order to reduce

(a) $\frac{dv}{dt}$ problem

(b) $\frac{di}{dt}$ problem

(c) the size of the pulse transformer

(d) the complexity of the firing circuit

28. The sharing of the voltages between thyristors operating in series is influenced by their

(a) $\frac{di}{dt}$ capabilities

(b) $\frac{dv}{dt}$ capabilities

(c) junction temperatures

(d) static v-i characteristics and leakage currents

29. Equalising circuits are provided across each SCR in series operation to provide uniform

(a) current distribution (b) firing of SCRs

(c) voltage distribution (d) none of the above

30. An SCR can be brought to forward conducting state with gate-circuit open when the applied voltage exceeds

(a) the forward breakover voltage

(b) reverse breakdown voltage

(c) 1.5V

(d) none of these

31. Turn-on time of an SCR can be reduced by using a

(a) rectangular pulse of high amplitude and narrow width

(b) rectangular pulse of low amplitude and wide width

(c) triangular pulse

(d) trapezoidal pulse

32. A forward voltage can be applied to an SCR after its

(a) anode current reduces to zero

(b) gate recovery time

(c) reverse recovery time

(d) anode voltage reduces to zero

33. A triac is a

(a) 2 terminal switch

(b) 2 terminal bilateral switch

(c) 3 terminal unilateral switch

(d) 3 terminal bidirectional switch

34. A resistor connected across the gate and cathode of an SCR

(a) increases $\frac{dv}{dt}$ rating of SCR

(b) increases holding current of SCR

(c) increases noise immunity of SCR

(d) increases turn-off time of SCR

35. Once SCR starts conducting a forward current its gate loses control over

(a) anode circuit voltage only.

(b) anode circuit current only.

(c) anode circuit voltage and current

(d) anode circuit voltage, current and time.

36. The turn-off time is longer than the turn-on time in SCR because

(a) The anode and cathode functions get reverse biased while gate junctions is still forward biased.

(b) the forward break-over voltage is high.

(c) the gate pulse has been removed.

(d) none of these.

37. When compared to those asymmetrical thyristor, the turn-off time and reverse blocking voltage of an asymmetrical thyristor respectively

(a) large and large (b) large and small

(c) small and large (d) small and small

38. Which of the following characteristics are possessed by IGBT

1. High input impedance
2. Secondary discharge problem
3. Current controlled device
4. Low switching loss
5. Faster than BJT

(a) 1,4 and 5 (b) 1,2 and 4

(c) 2, 3 and 5 (d) 1,3 and 5

39. The correct sequence of the following devices in the increasing order of turn-off times is

(a) MOSFET, IGBT, BJT, Thyristor

(b) IGBT, MOSFET, BJT, Thyristor

(c) Thyristor, BJT, MOSFET, IGBT

(d) MOSFET, BJT, IGBT, Thyristor

40. The correct sequence of given devices in the decreasing order of their speeds of operation is

(a) power BJT, power MOSFET, IGBT, SCR

(b) IGBT, power MOSFET power BJT, SCR

(c) SCR, power BJT, IGBT, power MOSFET

(d) power MOSFET, IGBT, power BJT, SCR

41. Power diodes has characteristic of

(a) High Power, High Speed

(b) Low Power, Low Speed

(c) Low Power, High Speed

(d) High Power, Low Speed

42. Triacs cannot be used in a.c. voltage regulator for a

(a) resistive load

(b) back emf load

(c) pure inductive load

(d) resistive inductive load

43. In a thyristor anode current is made up of
(a) electrons only (b) electrons or holes
(c) electrons and holes(d) holes only

44. If a diode is connected in anti-parallel with a thyristor, then
(a) both turn-off power loss and turn-off time decrease
(b) turn-off power loss decreases but turn-off time increase
(c) turn-off power loss increases but turn-off time decreases
(d) the arrangement works as a triac

45. The most suitable device for high frequency inversion in SMPS is
(a) BJT (b) IGBT
(c) MOSFET (d) GTO

46. Which semiconductor power device out of the following is not a current triggered device?
(a) Thyristor (b) GTO
(c) Triac (d) MOSFET

47. Which of the following does not cause permanent damage of an SCR?
(a) High current
(b) High rate of rise of current
(c) High temperature rise
(d) High rate of rise of voltage

48. The uncontrolled electronic switch employed in power electronic converters is
(a) thyristor
(b) bipolar junction transistor
(c) Diode
(d) MOSFET

49. In a commutation circuit employed to turn off an SCR, Satisfactory turn-off is obtained when.
(a) Circuit turn-off time < device turn-off time
(b) Circuit turn-off time > device turn-off time
(c) Circuit time constant > device turn-off time
(d) Circuit time constant < device turn-off time

50. Natural commutation of a thyristor takes place 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

51. SCR is a
(a) Voltage controlled device
(b) Charge controlled device
(c) Current controlled device
(d) None of these.

52. Maximum Rating of SCR available is
(a) 10 kV, 1 kA. (b) 5 kV, 3 kA
(c) 10 kV, 3 kA (d) 5 kV , 1 kA

53. When SCR are utilized for inverters, the switch off time range is
(a) 50 ~ 100 μsec. (b) 3 – 50 μsec
(c) 30 – 50 μsec (d) None of these

54. The magnitude of holding current for industrial SCR is about
(a) 50 mA (b) 100 mA
(c) 10 mA (d) None of these

55. The ratio of holding current to the latching current is about.
(a) 2 –3 (b) 4 – 5
(c) 0.33 to 0.5 (d) 0.5 to 1

56. The magnitude of gate current of a typical SCR is
(a) 20 to 200 m A (b) 20 to 200 μA.
(c) 200 to 500 μA. (d) None of these

57. On state voltage drop of a typical SCR is
(a) 0.7 to 1 Volt (b) 1 to 1.5 Volt
(c) 2–3 volt (d) None of these

58. Which of the following turn - on methods is most - suitable for SCR
(a) forward Voltage triggering
(b) gate triggering
(c) $\frac{dv}{dt}$ Triggering
(d) Thermal triggering

59. If gate current during gate triggering of SCR is increased, Breakover voltage of SCR (V_{BO})
(a) gets increased
(b) gets decreased
(c) Remains same
(d) None of these

60. During reverse baised mode of SCR if positive gate pulse is Applied.
(a) Reverse Blocking capacity increases
(b) SCR do not get affected
(c) SCR temperature increases
(d) SCR may get false turn - on

61. Which one is not in turn on process of SCR
(a) Peak time (b) rise time
(c) Delay time (d) Storage time

62. For $\frac{dv}{dt}$ protection and $\frac{dI}{dt}$ protection these are used Respectively.
(a) Inductor, Snubber circuit
(b) Snubber circuit, Inductor
(c) Snubber circuit, fuse
(d) None of these

63. For over voltage protection of SCR ___ is used
(a) snubber circuit
(b) Fuse
(c) metal oxide varistor
(d) None of these

64. For static voltage equalization of SCR string ___ is used
(a) Inductor /reactor
(b) Resistance
(c) Snubber circuit
(d) None of these

65. For dynamic equalization voltage of SCR string ____ is used
(a) reactor (b) Resistance
(c) Snubber circuit (d) None of these

66. For parallel operation of SCR string ____ is used
(a) Reactor (b) Resistance
(c) Snubber Circuit (d) None of these

67. Which of them is not correct about SCR and GTO comparision.
(a) $(\text{conduction loss})_{GTO} > (\text{conduction loss})_{SCR}$
(b) (GTO triggering current)> SCR triggering current)
(c) (switching speed of GTO)< (Switching speed of SCR)
(d) Latching current of GTO > Latching current of SCR.

68. Which of the comparision is not correct
(a) Holding current of GTO > SCR.
(b) Latching current of GTO > SCR
(c) Holding current of GTO = SCR
(d) None of these

69. TRIAC are used in
(a) residential lamp dimmers
(b) Domestic Heat control
(c) Speed control of small 1ϕ motors
(d) All of the above.

70. Breakover voltage of diac is about
(a) 80 – 100 V (b) 30 – 50 V
(c) 30 V (d) None of these

71. Triac is a — Layer device
(a) 3 (b) 4
(c) 5 (d) 6

□□□

Answer Key

1. ***Ans. (d)***

Controlled rectifier : fixed A.C. to pulsating (variable) D.C.

Chopper : Fixed D.C. to variable D.C.

Inverter : Fixed DC to variable voltage and variable frequency A.C.

Cycloconuerter : Fixed AC to variable frequency A.C.

2. ***Ans. (b)***
3. ***Ans. (c)***
4. ***Ans. (d)***
5. ***Ans. (c)***
6. ***Ans. (c)***
7. ***Ans. (d)***
8. ***Ans. (d)***
9. ***Ans. (c)***
10. ***Ans. (d)***
11. ***Ans. (b)***
12. ***Ans. (a)***
13. ***Ans. (c)***
14. ***Ans. (c)***
15. ***Ans. (a)***
16. ***Ans. (b)***
17. ***Ans. (b)***
18. ***Ans. (a)***

Peak inverse current depends on stored minority charges stored minority charges depend on the on ode forward current magnitude. Reverse recovery time depeands on the stored charges and value of $\frac{di}{dt}$

19. ***Ans. (d)***

When thyristor is turned on, then anode will be positive with respect to cathode. This will make J_1, & J_3 forward biased and J_2 reverse biased.

20. ***Ans. (b)***

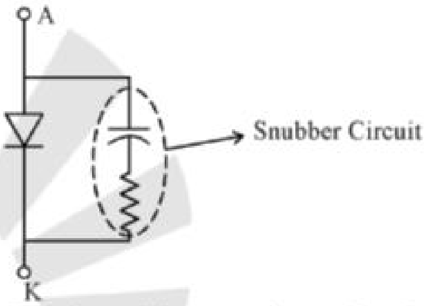
pulse transformer provides the electrical isolation between high power main circuit to low power gate triggering circuit.

21. ***Ans. (b)***

Transistor in switching operation works at higher frequency. At higher frequncies internal device junction capacitance plays vital role for turning-on and turning off a device. So turning on and turn-off depends on junction capacitance.

peak value of current

22. ***Ans. (b)***
23. ***Ans. (b)***



Capacitor will oppose the sudden changes in voltage. Thus for $\frac{dV}{dt}$ protection RC is connected across SCR.

24. ***Ans. (d)***

$\frac{di}{dt}$ capability of SCR depends on the formation of initial conduction area in device. If initial conduction area in device is large then $\frac{di}{dt}$ capability in more.

Gate pulse triggering has capability to produce more conduction area by large gate signal magnitude and large $\frac{di}{dt}$

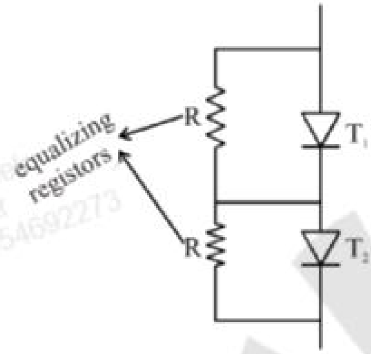
25. ***Ans. (d)***

If the amplitude of gate pluse to thyristor is increased, it will increase the initial conduction area in thyristor that will increase $\frac{di}{dt}$ in thyristor. Due to high $\frac{di}{dt}$, time to reach 0.1 I_A will decrease thus delay time decreases. Rise time mainly depends on circuit parameter. It is unaffected due to gate signal.

26. ***Ans. (c)***

Due to difference in i-v charteristic in thyristor, voltage across series connected thyristor will be different in blacking stage.

To equalize the voltage across thyristor, resistor with same value are connected across every thyristor.



27. ***Ans. (c)***

In transformer, with same KVA rating

$$\text{Size} \ \alpha \ \frac{1}{\text{frequency}}$$

So if frequency is increased, size can be reduce with same KVA rating.

So it is preferable to use a train of pulse of high frequency for gate triggering of SCR in order to reduce the size of pulse transformer.

28. ***Ans. (d)***

29. ***Ans. (c)***

30. ***Ans. (a)***

31. ***Ans. (a)***

32. ***Ans. (b)***

33. ***Ans. (d)***

34. ***Ans. (c)***

It increases noise immunity of SCR.

35. ***Ans. (c)***

36. ***Ans. (a)***

37. ***Ans.* (d)**

Turn off time and reverse blocking voltage both are small in asymmetrical thyristor and also On state voltage drop is less.

In ASCR reverse blocking voltage capability 20 to 30V and forward blocking voltage capability 400 to 2000 V,.

ASCR is are used in high frequency operations of less turn off time.

38. ***Ans. (a)***

In IGBT gate is insulated by Sio_2. So input impedance is very high. It is faster than BJT. Low switching losses are there.

39. ***Ans. (a)***

The order will be as follow for increasing value of turn-off time

MOSFET < IGBT < BJT < Thysistor.

40. ***Ans. (d)***

Order of speeds of operation

power MOSFET > IGBT > Power BJT > SCR

41. ***Ans. (d)***

Power diode is used in high power application. So it is high power and low frequency device.

42. ***Ans. (c)***

Triac are used with pure resistive load and R – L load with high value of resistance. It can not be used with pure inductive load.

43. ***Ans. (c)***

44. ***Ans. (b)***

45. ***Ans. (c)***

MOSFETs have the lowest switching losses. So they are the most suitable devices for the SMPS.

46. ***Ans. (d)***

MOSFET is a voltage control device.

47. ***Ans. (d)***

High rate of rise of voltage may turn on SCR with out giving trigger pulse. It can not damage SCR.

48. ***Ans. (c)***

49. ***Ans. (b)***

50. ***Ans. (d)***

51. ***Ans. (b)***

52. ***Ans. (b)***

53. ***Ans. (b)***

54. *Ans. (c)*
55. *Ans. (c)*
56. *Ans. (a)*
57. *Ans. (b)*
58. *Ans. (b)*
59. *Ans. (b)*
60. *Ans. (c)*
61. *Ans. (d)*
62. *Ans. (b)*
63. *Ans. (c)*
64. *Ans. (b)*
65. *Ans. (c)*
66. *Ans. (a)*
67. *Ans. (c)*
68. *Ans. (c)*
69. *Ans. (d)*
70. *Ans. (c)*
71. *Ans. (c)*

NOTES

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