POSTAL Book Package 2023

GATE • PSUs

Instrumentation Engineering

Objective Practice Sets

Electrical Circuits

Contents

MADE EASY Publications

1 CHAPTER
Circuit Element and Energy Sources

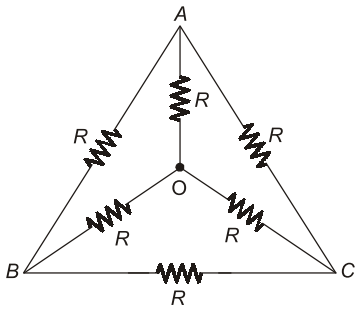
MCQ and NAT Questions

Q.1 The equivalent star impedance of a balanced delta connected load of value $6 + j9\ \Omega$ is given by

(a) $9 + j6\ \Omega$ (b) $2 + j3\ \Omega$

(c) $18 + j27\ \Omega$ (d) $6 - j9\ \Omega$

Q.2 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) $\frac{6}{11}R$

Q.3 A network contains only independent current sources and resistors. If the values of all resistors are doubled, the values of the node voltages

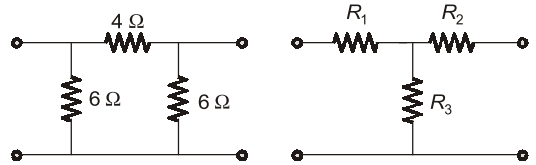
(a) will become half

(b) will remain unchanged

(c) will become double

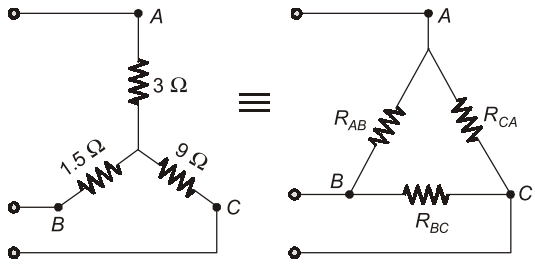
(d) cannot be determined unless the circuit configuration and the values of the resistors are known

Q.4 The value of R_1, R_2 and R_3 of the equivalent 'T' network for the given π network will be such that



	R_1	R_2	R_3
(a)	2.25 Ω	1.5 Ω	1.5 Ω
(b)	1.5 Ω	1.5	2.25 Ω
(c)	2.25 Ω	1.5 Ω	2.25 Ω
(d)	1.5 Ω	2.25 Ω	1.5 Ω

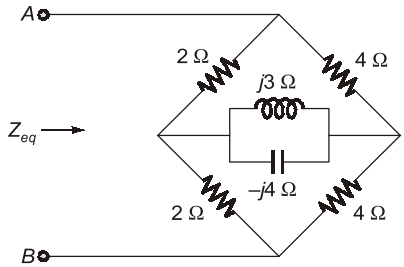
Q.5 For the equivalent @ figure circuit shown in the given figure, the values of R_{AB} and R_{BC} are respectively



(a) 5 Ω and 15 Ω (b) 15 Ω and 30 Ω

(c) 30 Ω and 5 Ω (d) 20 Ω and 35 Ω

Q.6 In the circuit of figure. The equivalent impedance seen across terminals A, B is _____ Ω.

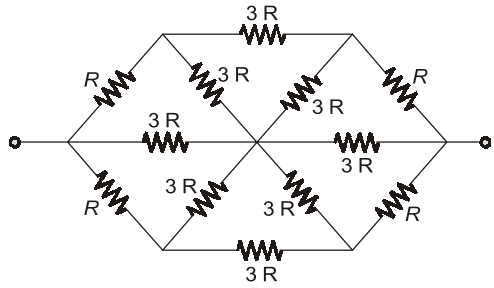


Q.7 If each branch of a delta circuit has impedance $Z/\sqrt{3}$ then, each branch of the equivalent Y circuit has impedance.

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

(c) $3\sqrt{3}Z$ (d) $Z/3$

Q.8 The equivalent resistance between terminals A and B for the circuit shown is:



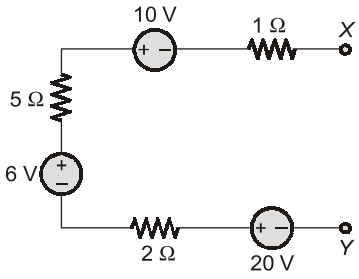
Q.25 **Assertion (A):** Inductors carrying steady direct currents act as effective short circuits with zero voltage across it.

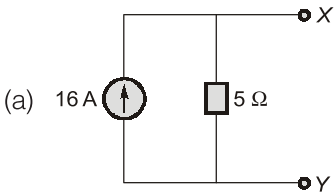
Reason (R): The voltage induced across an inductance is proportional to the rate of change of current *di*/*dt*.

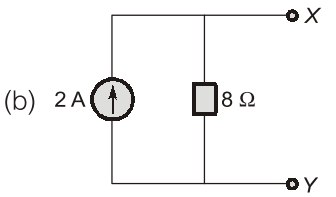
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not a correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

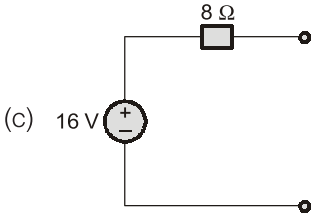
Multiple Select Questions (MSQs)

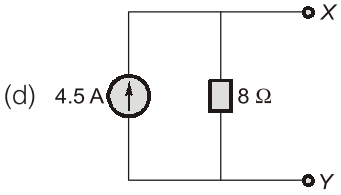
Q.26 The circuit shown below will be represented as



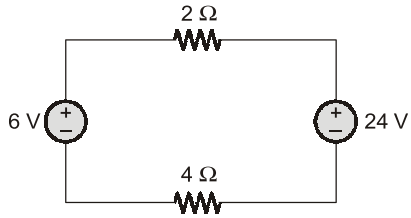
(a)


(b)


(c)


(d)


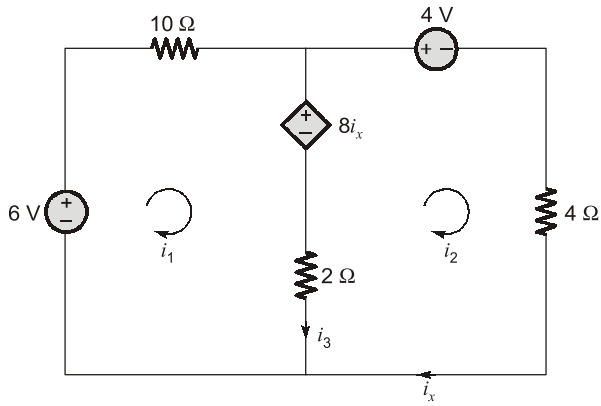
Q.27 For the circuit shown below :



Which of the following is correct?

(a) Power delivered by 24 V source is 72 W.
(b) Power absorbed by 4 Ω resistance is 36 W.
(c) Power delivered by 24 V source is 0 W.
(d) Power delivered by 6 V source is 18 W.

Q.28 For the circuit shown below :



Which of the following is correct?

(a) $i_1 = -1$ A (b) $i_2 = -3$ A
(c) $i_3 = 4$ A (d) $i_x = 3$ A

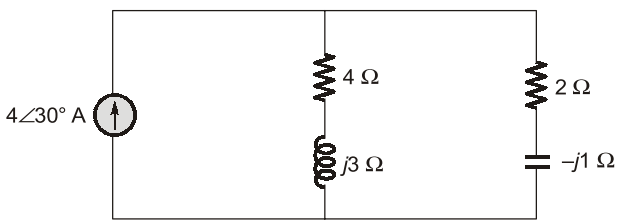
Q.29 A series circuit containing passive elements has the following current and applied voltage :

$$V = A\sin\left(\omega t + \frac{\pi}{4}\right)\text{V} \quad ; \quad i = B\sin\left(\omega t - \frac{\pi}{6}\right)\text{A}$$

The circuit elements :

(a) may be resistance and inductance.
(b) may be inductance, capacitance and resistance.
(c) may be resistance.
(d) may be resistance and capacitance.

Q.30 Consider the circuit shown in the figure below :



Which of the following statement is correct?

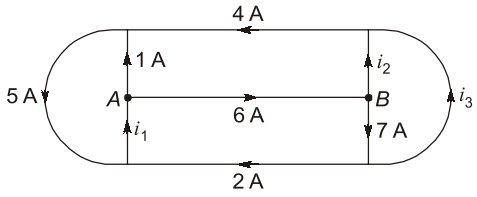
(a) The power supplied by the current source is 14 W.

(b) The average power absorbed by the capacitor is 0 W.

(c) The average power absorbed by the 4 Ω resistor is 4 W.

(d) The average power absorbed by the 2 Ω resistor is 11 W.

Q.31 For the given circuit :



Which of the following is correct?

(a) $i_1 = 7$ A (b) $i_3 = 5$ A

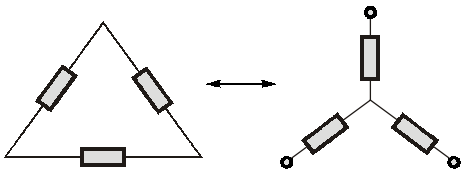
(c) $i_2 = 1$ A (d) $i_2 = -1$ A

Answers Circuit Element and Energy Sources

1.	(b)	**2.**	(c)	**3.**	(c)	**4.**	(b)	**5.**	(a)	**6.**	(2.67)	**7.**	(b)
8.	(c)	**9.**	(b)	**10.**	(b)	**11.**	(c)	**12.**	(d)	**13.**	(a)	**14.**	(c)
15.	(b)	**16.**	(c)	**17.**	(a)	**18.**	(d)	**19.**	(a)	**20.**	(b)	**21.**	(d)
22.	(d)	**23.**	(c)	**24.**	(a)	**25.**	(a)	**26.**	(b, c)	**27.**	(a, b)	**28.**	(a, d)
29.	(a, b)	**30.**	(a, b, c)	**31.**	(a, b, d)								

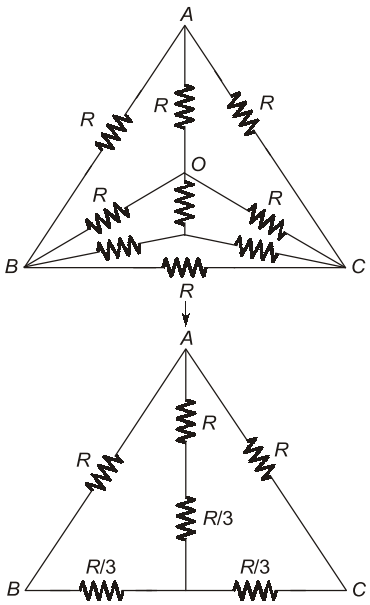
Explanations Circuit Element and Energy Sources

1. (b)



$$Z' = \frac{Z \times Z}{3Z} = \frac{Z}{3} = \frac{6 + j9}{3} = 2 + j3$$

2. (c)



$$R_{AB} = R \left\| \left(\frac{R}{3} + \left(\frac{4R}{3} \right\| \frac{4R}{3} \right) \right) = \frac{R}{2}$$

3. (c)

Since the network contains only independent current sources, so changing resistors in the same proportion the current through each branch will remain same but node voltages will change in the same proportion. Hence, doubling all resistors, node voltages will be doubled.

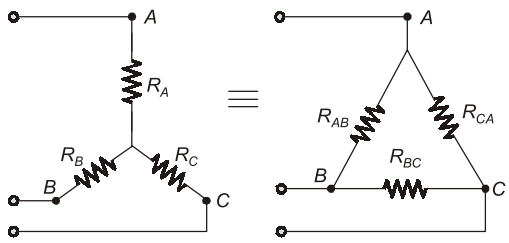
4. (b)

$$R_1 = \frac{4 \times 6}{4 + 6 + 6} = \frac{24}{16} = 1.5\ \Omega$$

$$R_2 = \frac{6 \times 4}{16} = 1.5\ \Omega$$

$$R_3 = \frac{6 \times 6}{16} = 2.25\ \Omega$$

5. (a)



$$R_{AB} = R_A + R_B + \frac{R_A R_B}{R_C}$$

$$R_{AB} = 3 + 1.5 + \frac{3 \times 1.5}{9}$$

$$= 3 + 1.5 + 0.5 = 5\ \Omega$$

$$R_{BC} = 9 + 1.5 + \frac{9 \times 1.5}{3}$$

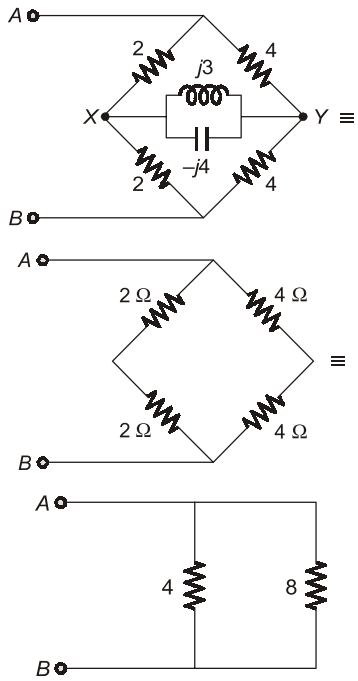
$$= 9 + 1.5 + 4.5 = 15\ \Omega$$

$$R_{CA} = R_A + R_C + \frac{R_A R_C}{R_B}$$

$$= 3 + 9 + \frac{3 \times 9}{1.5} = 30\ \Omega$$

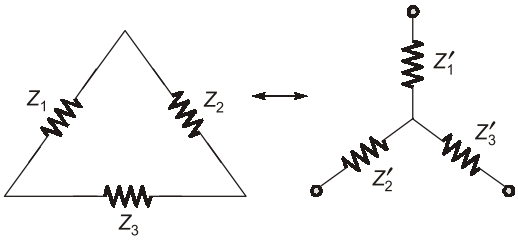
6. Sol.

The above circuit is a Wheatstone bridge circuit, thus no current will flow through branch XY.



$$Z_{eq} = 8 \,||\, 4 = \frac{8 \times 4}{12} = \frac{8}{3} = 2.67\ \Omega$$

7. (b)



$$Z_1' = \frac{Z_1 Z_2}{Z_1 + Z_2 + Z_3}$$

$$Z_2' = \frac{Z_1 Z_3}{Z_1 + Z_2 + Z_3}$$

$$Z_3' = \frac{Z_2 Z_3}{Z_1 + Z_2 + Z_3}$$

$$Z_1' = \frac{\frac{Z}{\sqrt{3}} \times \frac{Z}{\sqrt{3}}}{\frac{Z}{\sqrt{3}} + \frac{Z}{\sqrt{3}} + \frac{Z}{\sqrt{3}}}$$

$$= \frac{\frac{Z^2}{(\sqrt{3})^2}}{\frac{3Z}{\sqrt{3}}} = \frac{Z^2\sqrt{3}}{3Z \times 3}$$

$$\Rightarrow \quad Z'_1 = \frac{Z}{3\sqrt{3}}$$

8. (c)