POSTAL Book Package 2021

Instrumentation Engineering

Objective Practice Sets

Electrical Circuits

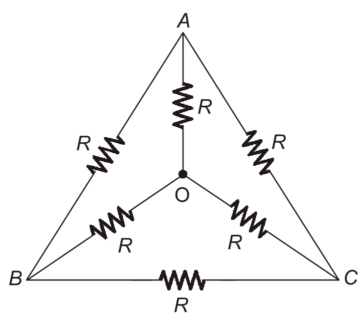
Contents

MADE EASY Publications

1 CHAPTER
Circuit Element and Energy Sources

Q.1 The equivalent star impedance of a balanced delta connected load of value $6 + j\,9\ \Omega$ is given by
(a) $9 + j6\ \Omega$ (b) $2 + j3\ \Omega$
(c) $18 + j27\ \Omega$ (d) $6 - j9\ \Omega$

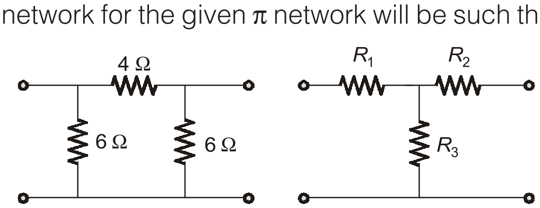
Q.2 The effective resistance between the terminals *A* and *B* in the circuit shown in the figure is



(a) R (b) $R - 1$
(c) $\frac{R}{2}$ (d) $\frac{6}{11}R$

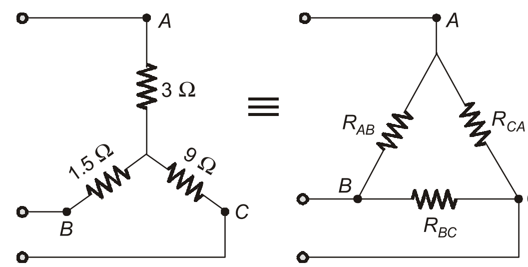
Q.3 A network contains only independent current sources and resistors. If the values of all resistors are doubled, the values of the node voltages
(a) will become half
(b) will remain unchanged
(c) will become double
(d) cannot be determined unless the circuit configuration and the values of the resistors are known

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



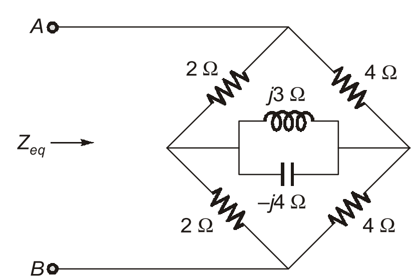
	R_1	R_2	R_3
(a)	2.25 Ω	1.5 Ω	1.5 Ω
(b)	1.5 Ω	1.5	2.25 Ω
(c)	2.25 Ω	1.5 Ω	2.25 Ω
(d)	1.5 Ω	2.25 Ω	1.5 Ω

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



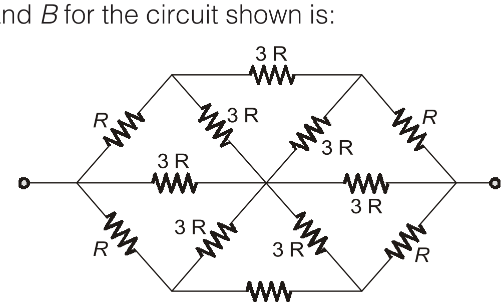
(a) 5 Ω and 15 Ω (b) 15 Ω and 30 Ω
(c) 30 Ω and 5 Ω (d) 20 Ω and 35 Ω

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.

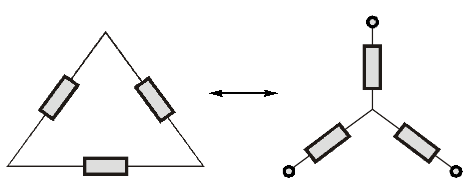
■■■■

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)		

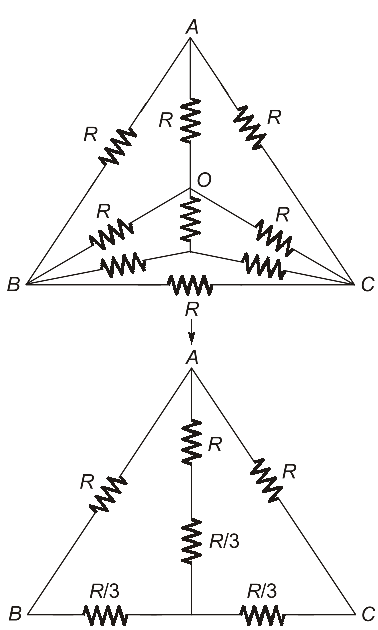
Explanations — Circuit Element and Energy Sources

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.

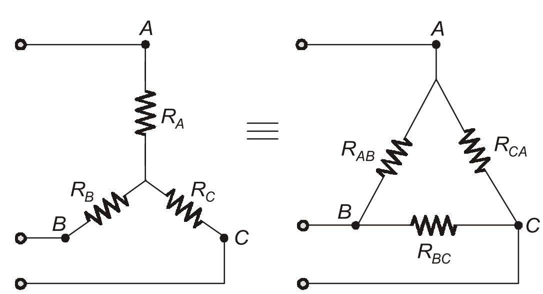
4. (b)

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

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

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

5. (a)



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

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

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

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

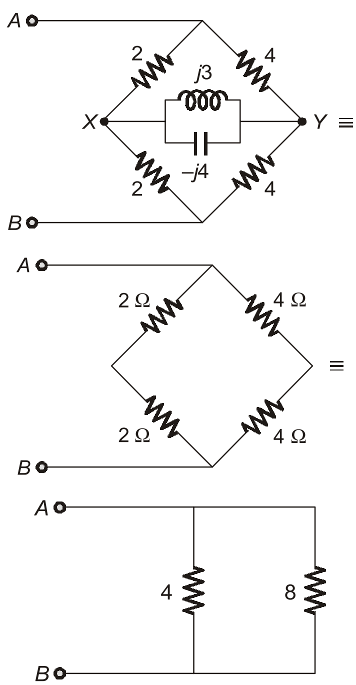
$$= 9 + 1.5 + 4.5 = 15\ \Omega$$

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

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

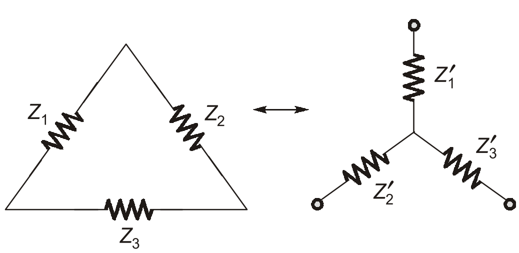
6. Sol.

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)



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

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

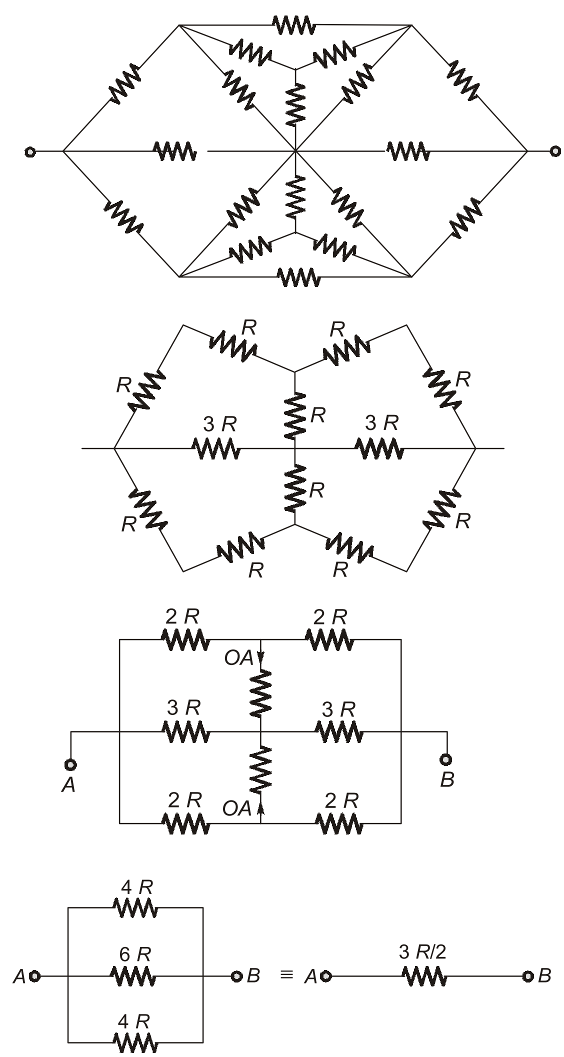
$$Z_3' = \frac{Z_2 Z_3}{Z_1 + Z_2 + Z_3}$$

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

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

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

8. (c)



9. (b)

$$R_A = \frac{R_b R_c}{R_a + R_b + R_c} = K \cdot \left(\frac{R_c R_b}{R_a + R_b + R_c} \right)$$

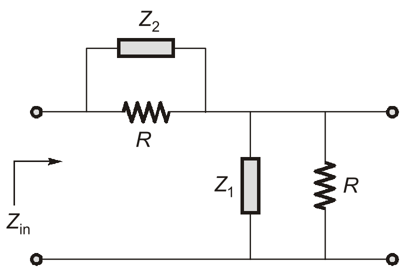
$$R_B = \frac{R_a R_c}{R_a + R_b + R_c} = K \cdot \left(\frac{R_a R_c}{R_a + R_b + R_c} \right)$$

with 'a' and 'b' doubled,

$$R' = \frac{\rho}{2}\frac{(2a+2b)}{(2a-2b)^2}$$

$$= \frac{\rho}{4}\frac{a+b}{(a-b)^2} = \frac{R}{2}$$

24. (a)



$$Z_{in} = R$$

$$\frac{Z_{in}}{R} = \frac{Z_1}{R+Z_1} + \frac{Z_2}{R+Z_2}$$

$$\frac{R}{R} = 1 = \frac{Z_1}{R+Z_1} + \frac{Z_2}{R+Z_2}$$

$$1 - \frac{Z_1}{R+Z_1} = \frac{Z_2}{R+Z_2}$$

$$\frac{R}{R+Z_1} = \frac{Z_2}{R+Z_2}$$

$$Z_2 = R$$

$$Z_1 = Z_2 = R$$

25. (a)

$$V_L \propto \frac{di}{dt}; \quad V_L = L\frac{di}{dt}$$

For d.c. $\quad \frac{di}{dt} = 0 \Rightarrow v = 0$

Inductor acts as short-circuit.

■■■■