MADE EASY PUBLICATIONS

POSTAL BOOK PACKAGE 2025

ELECTRICAL ENGINEERING

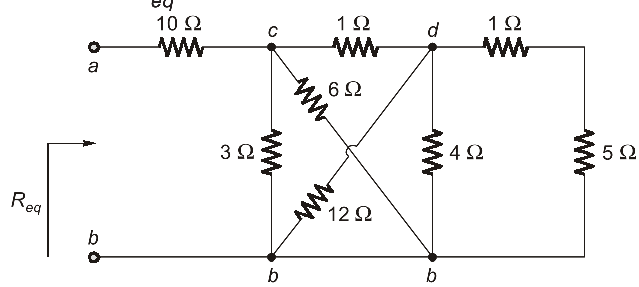
CONVENTIONAL Practice Sets

CONTENTS

ELECTRIC CIRCUITS

1 CHAPTER
Basics, Circuit Elements, Nodal & Mesh Analysis

Q.1 Calculate equivalent resistance R_{eq} in the circuit shown.



Solution:

3 Ω and 6 Ω resistors are in parallel because they are connected to same two nodes c and b. Their combined resistance is

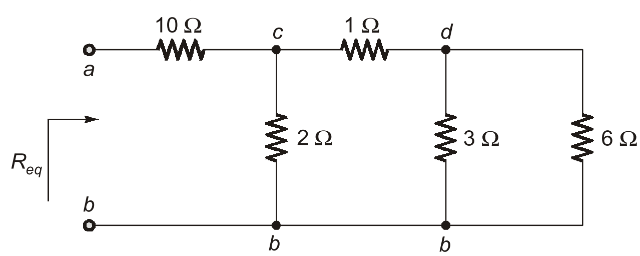
$$3\,\Omega\,||\,4\,\Omega = \frac{3\times 6}{3+6} = 2\,\Omega$$

Similarly, 12 Ω and 4 Ω resistors are in parallel since they are connected to same two nodes *d* and *b*.

Hence,
$$12\,\Omega\,||\,4\,\Omega = \frac{12\times 4}{12+4} = 3\,\Omega$$

Also, 1 Ω and 5 Ω resistors are in series, hence combined resistance,

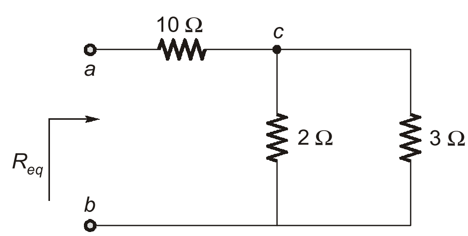
$$1\,\Omega + 5\,\Omega = 6\,\Omega$$



Further 3 Ω and 6 Ω in parallel gives equivalent resistance $= \dfrac{3\,\Omega\times 6\,\Omega}{(3+6)\,\Omega} = 2\,\Omega$

This 2 Ω is in series with 1 Ω.

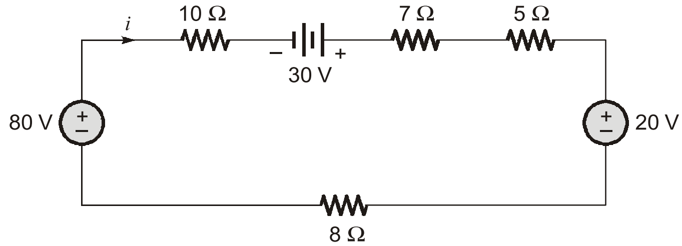
Given equivalent as (2 + 1) Ω = 3 Ω as shown below.



Now 2 Ω and 3 Ω parallel's combination in series with 10 Ω resistance.

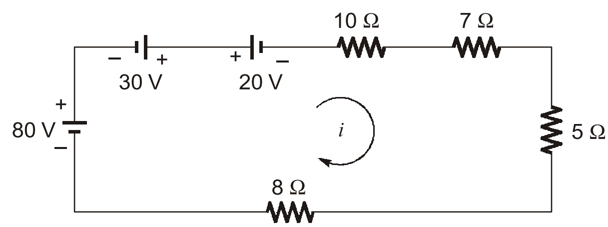
Hence,
$$R_{ab} = R_{eq} = 10\,\Omega + (2\,\Omega\,||\,3\,\Omega)$$
$$= 10 + \frac{2\times 3}{2+3} = 11.2\,\Omega$$

Q.2 Use resistance and source combinations to determine the current i in figure shown and power delivered by 80 V source.



Solution:

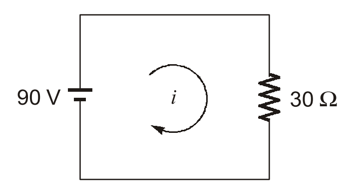
The circuit can be redrawn as,



Further combining the three voltage sources into an equivalent source of 90 V as shown below.

All the resistance, combined in series as,

$$R_{eq} = (10 + 7 + 5 + 8)\ \Omega = 30\ \Omega$$



Simply applying kVL, $-90 + 30i = 0$

Hence, $i = 3$ A

Power delivered by 80 V source $= 80\text{ V} \times 3\text{ A} = 240$ W

Q.3 The following mesh equations pertain to a network:

$$8I_1 - 5I_2 - I_3 = 110$$
$$-5I_1 + 10I_2 + 0 = 0$$
$$-I_1 + 0 + 7I_3 = 115$$

Draw network showing each element.

Solution:

All the mesh equations can be rearrangement as,

$$8I_1 - 5I_2 - I_3 = 110$$

$\Rightarrow$ $$5(I_1 - I_2) + (I_1 - I_3) + 2I_1 = 110 \quad \text{...(1)}$$

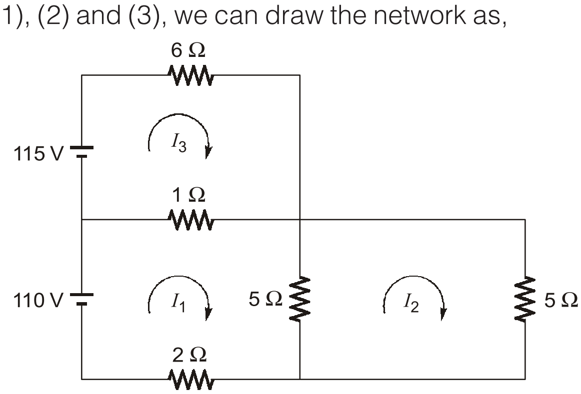
$$-5I_1 + 10I_2 + 0 = 0$$

$\Rightarrow$ $$5(I_2 - I_1) + 5I_2 = 0 \quad \text{...(2)}$$

$$-I_1 + 0 + 7I_3 = 115$$

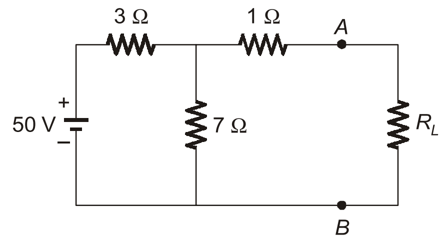
$\Rightarrow$ $$(I_3 - I_1) + 6I_3 = 115 \quad \text{...(3)}$$

On the basis of equation (1), (2) and (3), we can draw the network as,



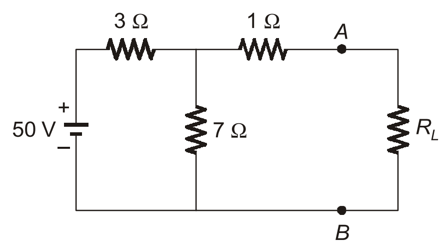
Circuit Theorems

Q.1 What is the value of Thevenin voltage E_{Th} in the given circuit of figure?

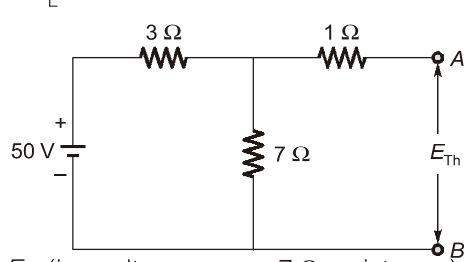


Solution:

Given circuit is,



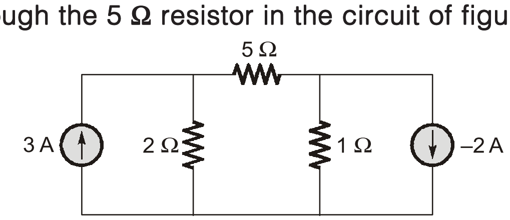
Step-1: Remove load resistance R_L



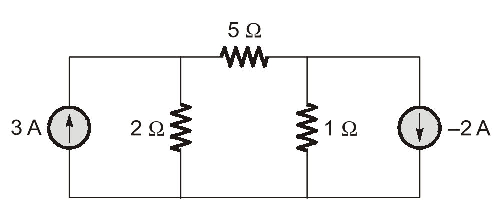
Step-2: Find Thevenin voltage E_{Th} (i.e. voltage across 7 Ω resistance)

$$E_{Th} = \frac{7 \times 50}{(7+3)} = 35 \text{ V}$$

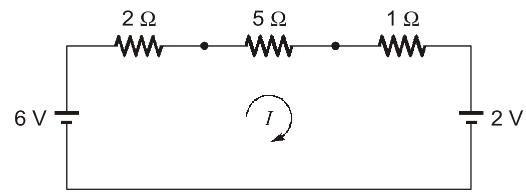
Q.2 Determine the current through the 5 Ω resistor in the circuit of figure.



Solution:

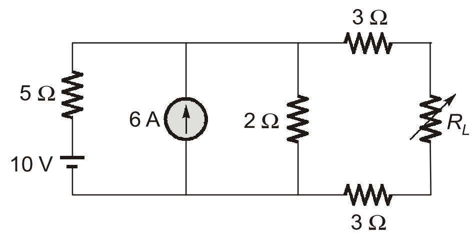


Applying source transformation:



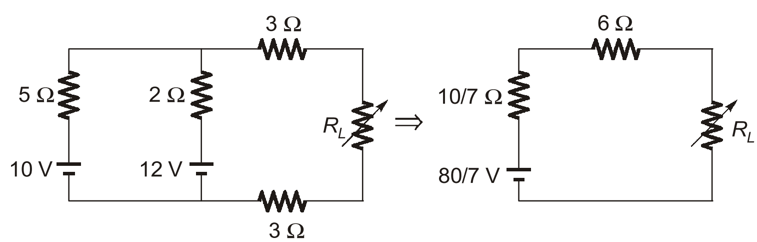
$$I = \frac{6-(+2)}{5+2+1} = \frac{4}{8} = 0.5 \text{ A}$$

Q.3 Find the maximum power that can be transferred to R_L.



Solution:

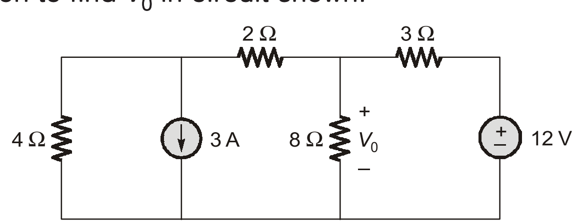
We remove R_L, convert the current source into a voltage source and using Millman's theorem reduce the network.



$$\text{Maximum power is transferred at } R_L = 6 + \frac{10}{7} = 7.43\ \Omega$$

$$P_{max} = \frac{\left(\frac{80}{7}\right)^2}{4 \times 7.43} = 4.39 \text{ W}$$

Q.4 Use source transformation to find V_0 in circuit shown.



Solution:

Using source transformation,

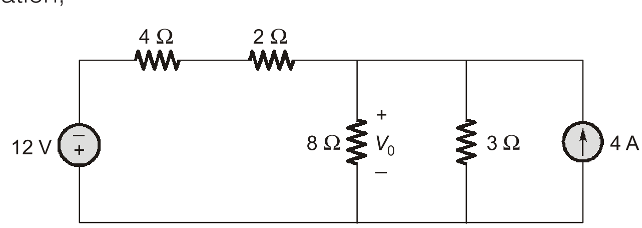


Figure (a)