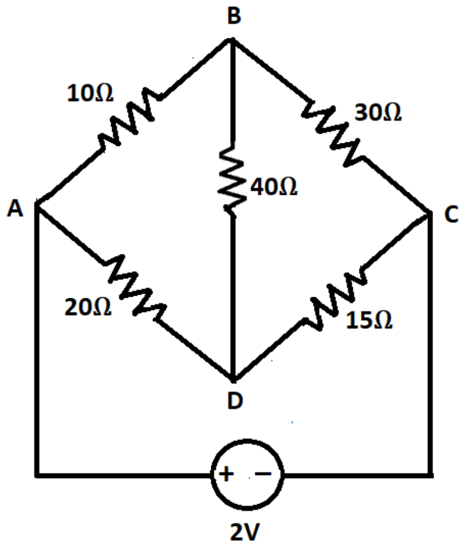
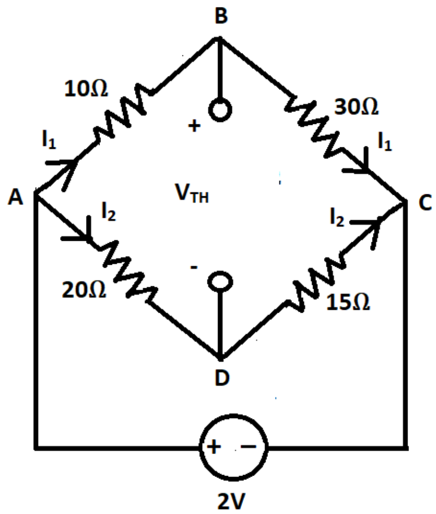
Notes Class- 15

Numerical Example on Thevenin's Theorem:
Numerical Example 1:
Using Thevenin's Theorem, find the magnitude and direction of current in the branch BD in the network shown.



Solution:
Finding V_{TH} : Here 40Ω resistor is the load resistor.



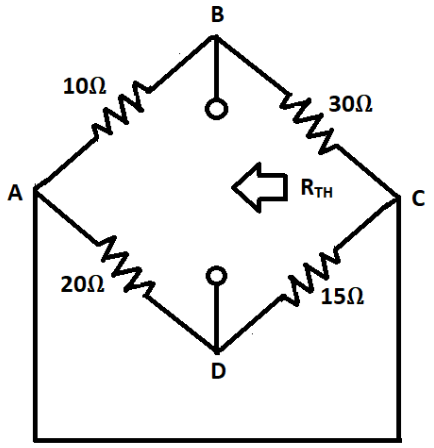
Here, 10Ω and 30Ω are in series. Hence, $I_1 = \frac{2V}{40\Omega} = 0.05A$

Also, 20Ω and 15Ω are in series. Hence, $I_2 = \frac{2V}{35\Omega} = 0.057A$

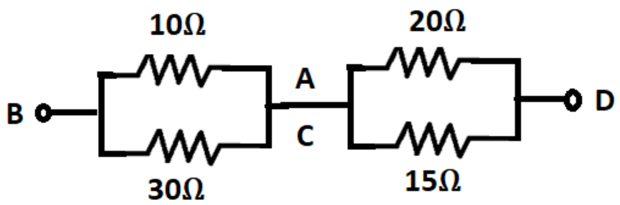
By KVL (ACDA), $-10*I_1 - V_{TH} + 20*I_2 = 0$

Hence, $V_{TH} = 0.64V$

Finding R_{TH} :

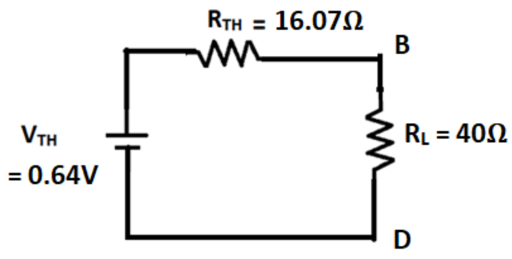


The above network can be rearranged as follows:



Hence, R_{TH} = (10Ω II 30Ω) + (20Ω II 15Ω) = 16.07Ω.

Thevenin's Equivalent Circuit:

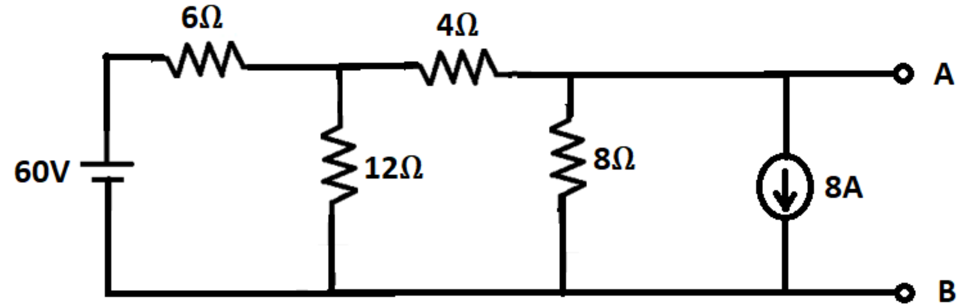


Load current $I_L = \frac{V_{TH}}{R_{TH}+R}$

Hence, current through the branch BD is 11.41mA and flows from terminal B to terminal D.

Numerical Example 2:

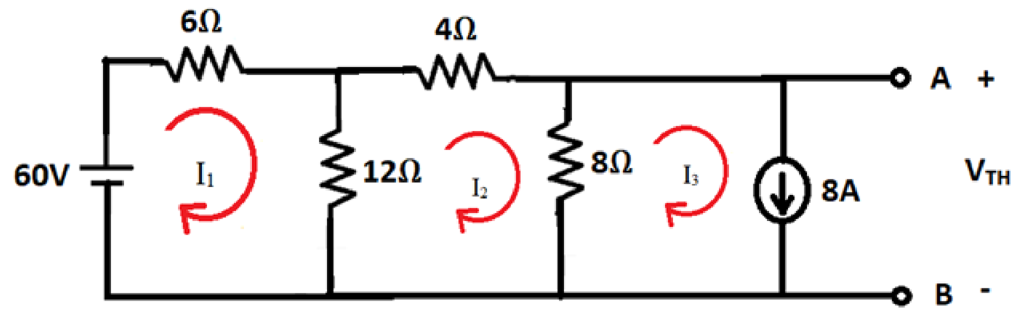
Obtain the Thevenin's Equivalent across the terminals A & B for the network given.



Solution:

Note: In this network, there is no load resistance. Entire network needs to be replaced with its Thevenin's Equivalent i.e., V_{TH} in series with R_{TH}.

Finding V_{TH} :



KVL (Mesh 1) : $18I_1-12I_2-0I_3 = 60$ ---- (1)

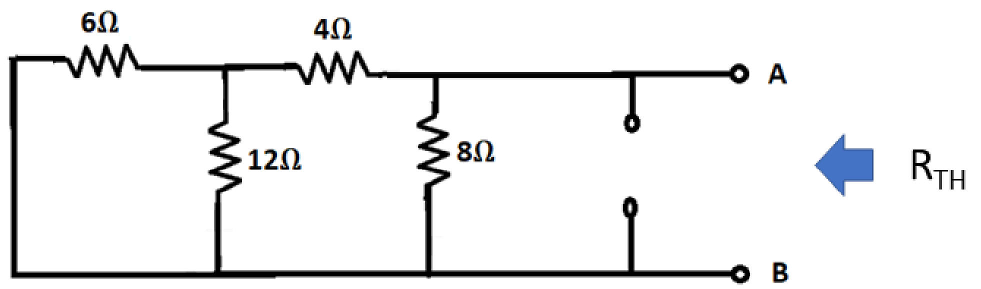
KVL (Mesh 2) : $-12I_1+24I_2-8I_3 = 0$ ---- (2)

Current Equation(Mesh 3) : $I_3 = 8$ ---- (3)

Solving (1), (2) & (3), $I_1 = 7.66A$; $I_2 = 6.5A$

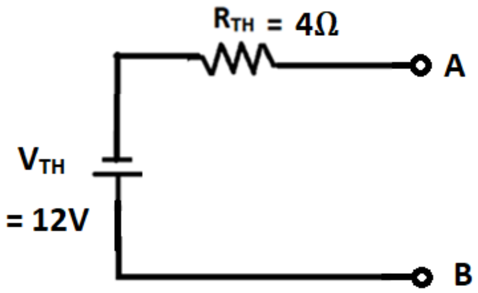
Hence, $V_{TH} = (I_2-I_3)*8\Omega = -12V$

Finding R_{TH} :



Hence, R_{TH} = {(6Ω II 12Ω) +4Ω) II 8Ω} = 4Ω

Thevenin's Equivalent Circuit:



Here, since V_{TH} has turned out to be negative, it can be represented in the equivalent network with battery polarity reversed.