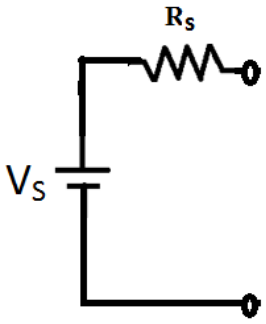
NOTES – CLASS 3

Practical Voltage & Current Sources:

Practical Voltage Source:

In a practical voltage source, terminal voltage falls as load current increases. It is modelled as an ideal voltage source in series with internal resistance. A practical voltage source is represented as shown below:

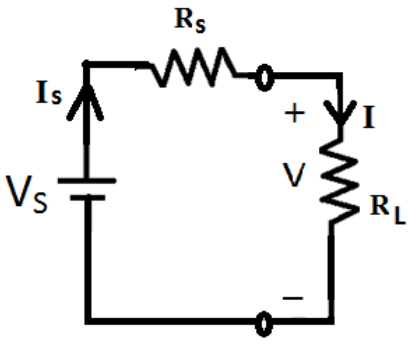


Here, R_S represents its internal resistance.

Internal resistance of a practical voltage source is small, usually few mΩ.

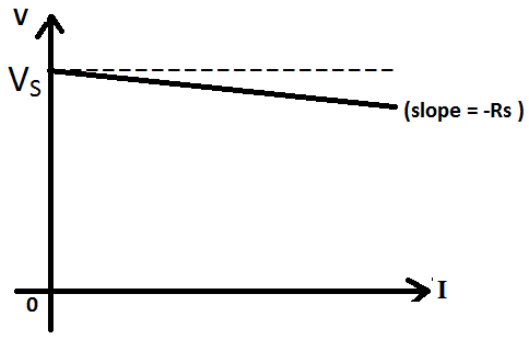
Internal resistance of an ideal voltage source is Zero.

When terminated with a load resistance R_L, the terminal voltage is given by the following equation:



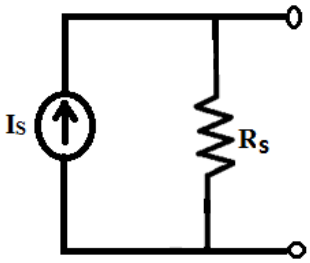
$$V = V_S - I*R_S$$

It exhibits a terminal voltage current characteristic as shown below:



Practical Current Source:

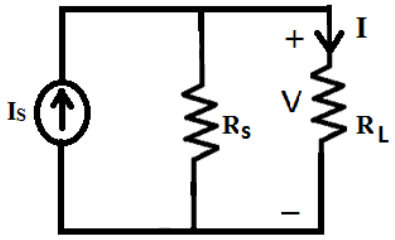
In a practical current source, load current falls as terminal voltage increases. It is modelled as an ideal current source in parallel with internal resistance. A practical current source is represented as shown below:



Here, R_S represents its internal resistance.

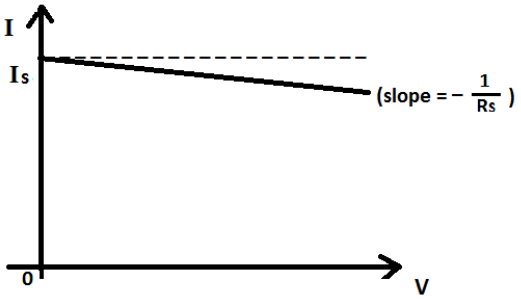
Internal resistance of a practical current source is very high, usually few MΩ.

When terminated with a load resistance R_L, the terminal current is given by the following equation:



$$I = I_S - \left(\frac{V}{R_S}\right)$$

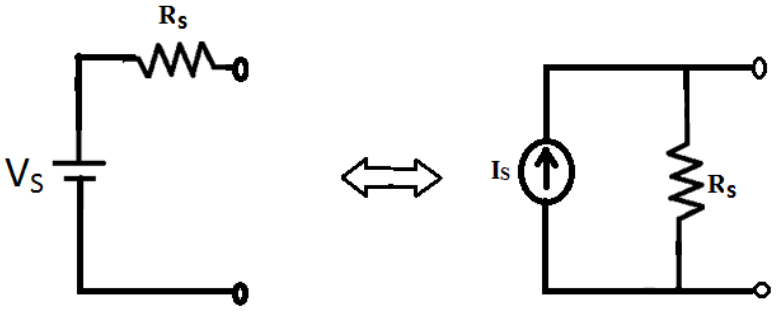
It exhibits a terminal voltage current characteristic as shown below:



Source Transformation:

Source Transformation is applicable to practical sources only.

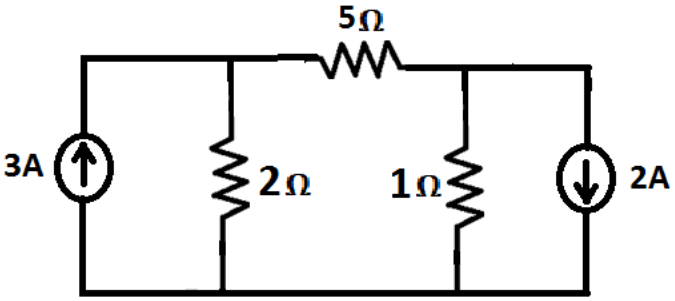
A Practical Voltage Source can be transformed to a Practical Current Source & Vice versa by Source Transformation.



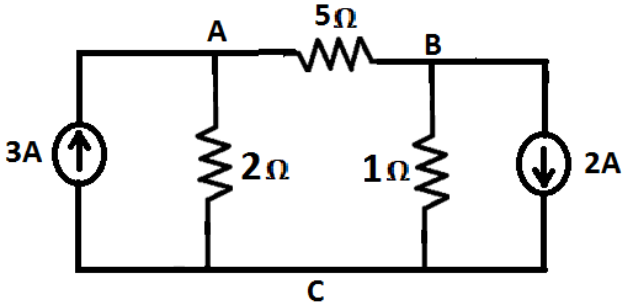
Here, V_S and I_s are related by, $V_S = I_S * R_S$

Numerical Example on Source Transformation:

Find the current through 5Ω resistor in the network shown using source transformation.

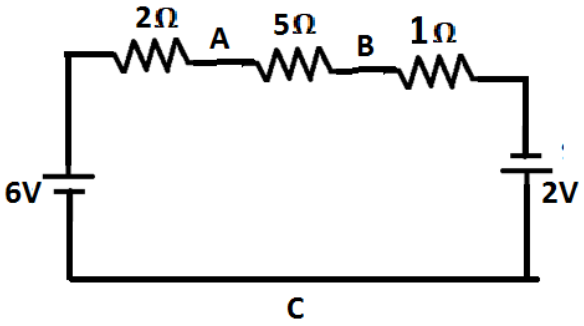


Solution:

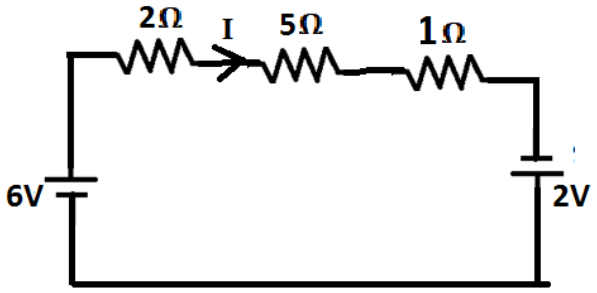


Replace 3A current source & 2Ω resistance with equivalent practical voltage source of EMF = (3A*2Ω) = 6V in series with 2Ω resistance.

Replace 2A current source & 1Ω resistance with equivalent practical voltage source of EMF = (2A*1Ω) = 2V in series with 1Ω resistance.



Consider a current I in this network.



By applying KVL, +6 – 2*I – 5*I – 1*I + 2 = 0

I = 1A

Hence, current through 5Ω resistor is 1A.