ELEMENTS OF ELECTRICAL ENGINEERING
Course Code : UE25EE141A/B

PES UNIVERSITY

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ELEMENTS OF ELECTRICAL ENGINEERING

Practical Sources and Source Transformation

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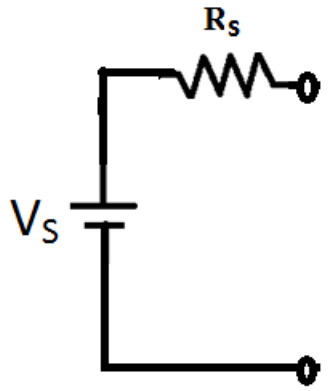
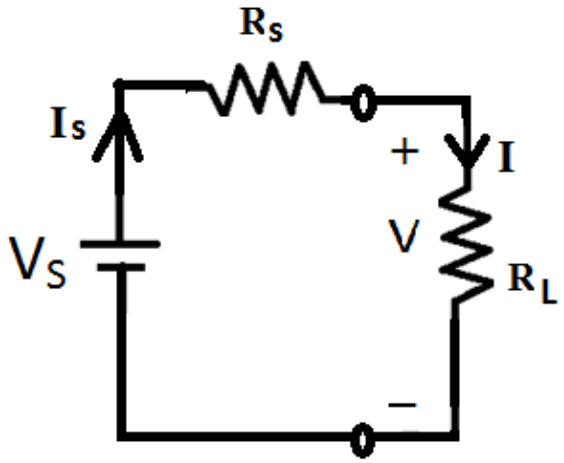
Practical Voltage Source

- Its terminal voltage falls as load current increases.
- It is modelled as an ideal voltage source in series with internal resistance.

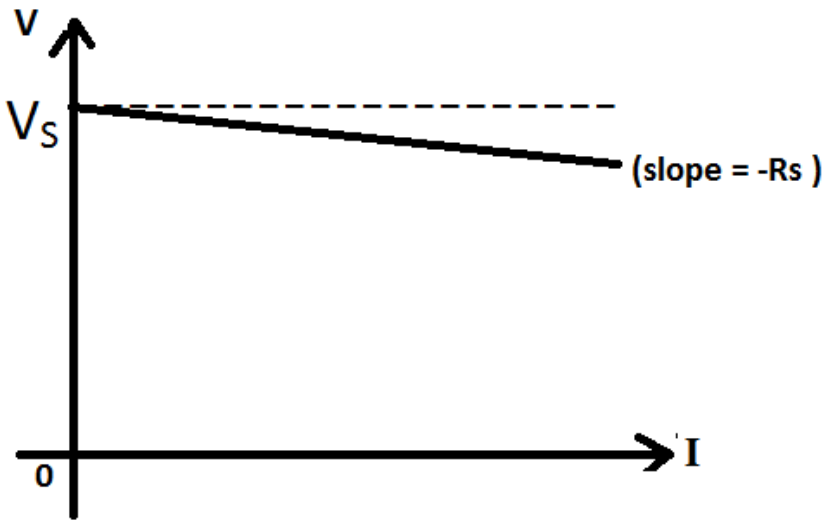


- Internal resistance is small, usually few mΩ.
- Internal resistance of an ideal voltage source is Zero

Practical Voltage Source

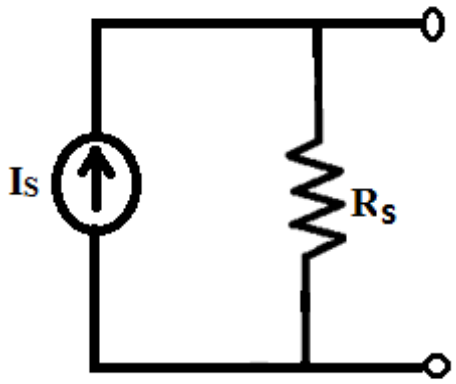


$$V = V_S - I*R_S$$



Practical Current Source

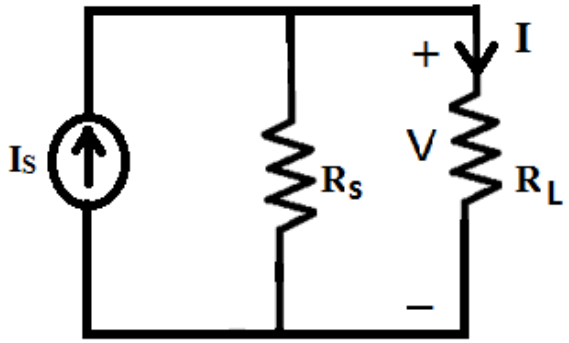
- Its terminal current falls as load voltage increases.
- It is modelled as an ideal current source in parallel with internal resistance.



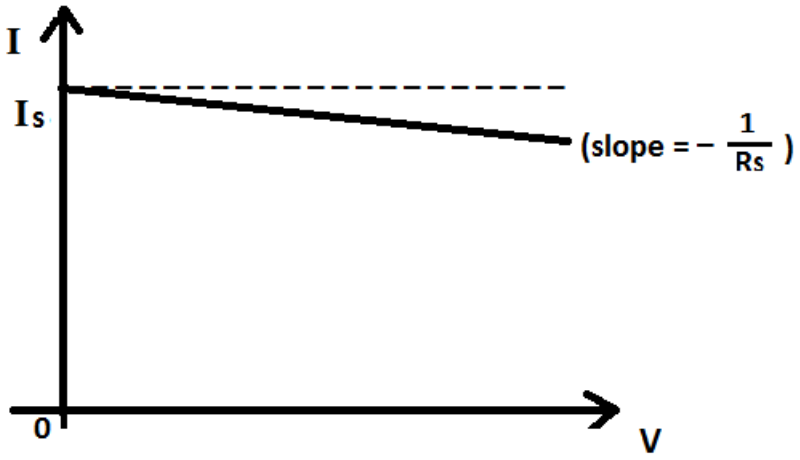
- Internal resistance is very high, usually few Mega Ohms
- Internal resistance of an ideal current source is Infinite

ELEMENTS OF ELECTRICAL ENGINEERING

Practical Current Source

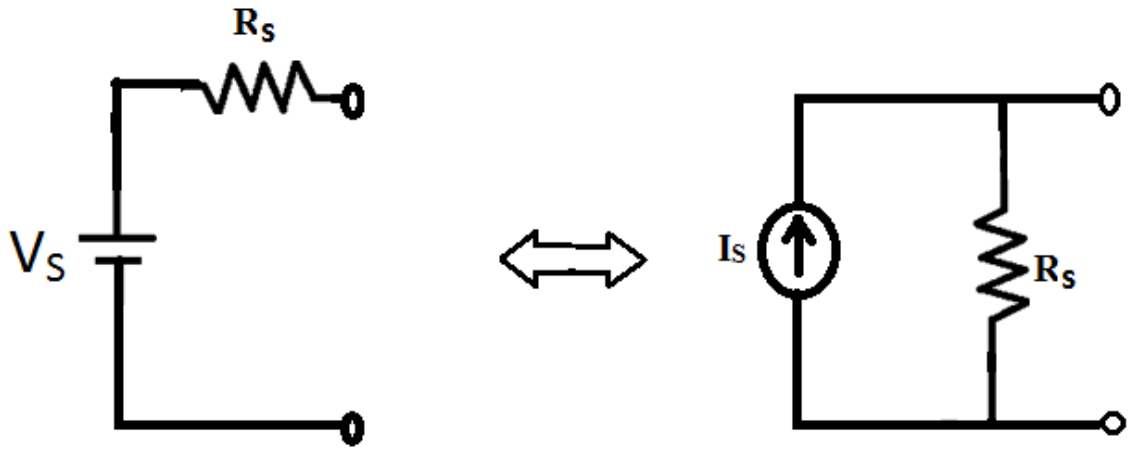


$$I = I_S - \left(\frac{V}{R_S}\right)$$



Source Transformation

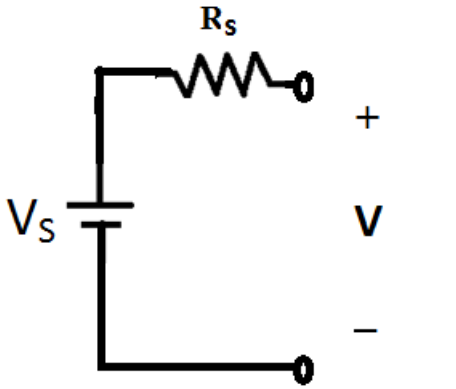
A Practical Voltage Source can be transformed to a Practical Current Source & Vice versa.



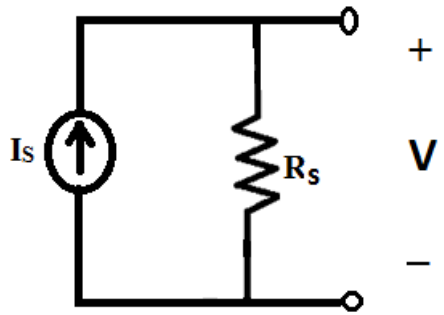
Two Sources are equivalent if they supply same terminal voltage and current when loaded with same load resistance.

Source Transformation

Case 1: Open Circuit Condition



$V = V_S$

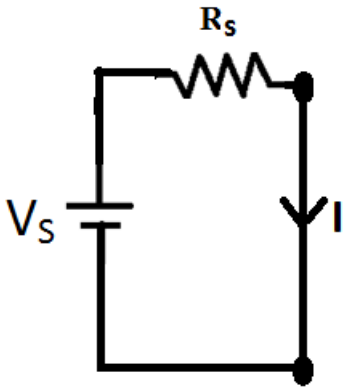


$V = I_S * R_S$

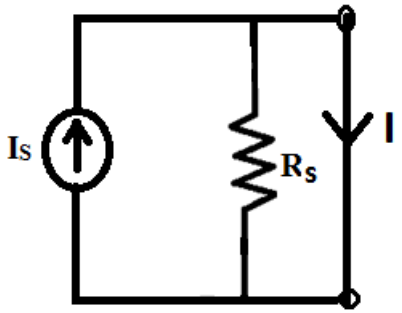
Hence, $V_S = I_S * R_S$

Source Transformation

Case 2: Short Circuit Condition



$$I = \frac{V_S}{R_S}$$



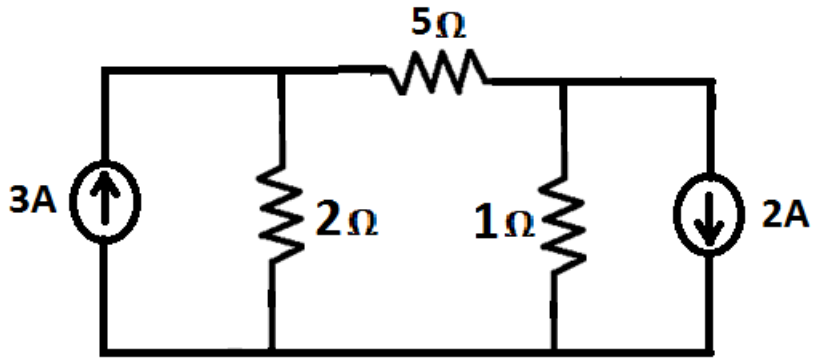
$$I = I_S$$

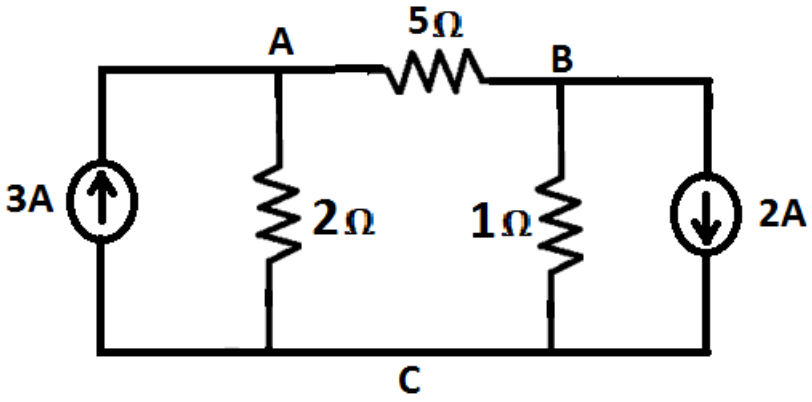
Hence, $V_S = I_S * R_S$

Numerical Example on Source Transformation

Question:

Find the current through 5Ω resistor in the network shown:



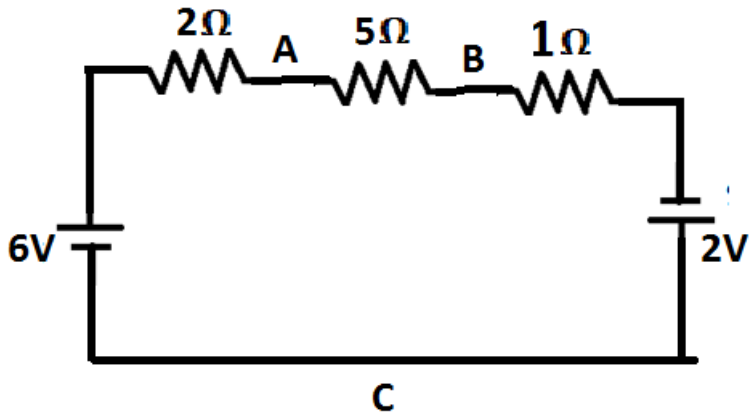


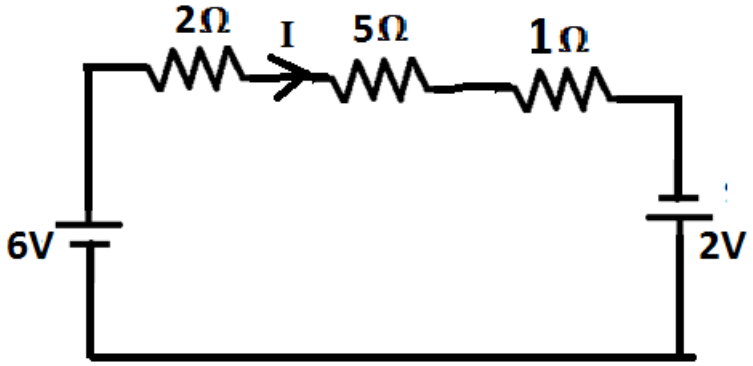
Replace 3A current source & 2Ω resistance with equivalent practical voltage source.

Repeat the same for 2A current source & 1Ω resistance.

Numerical Example on Source Transformation

Solution (Continued..):





By applying KVL

$+6-2I - 5I - I+2 = 0$

$I = 1A$

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Text Book & References

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10th Edition McGraw Hill, 2023

2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.

THANK YOU

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