Paper 1, TDC Part-1
Source Transformation 2

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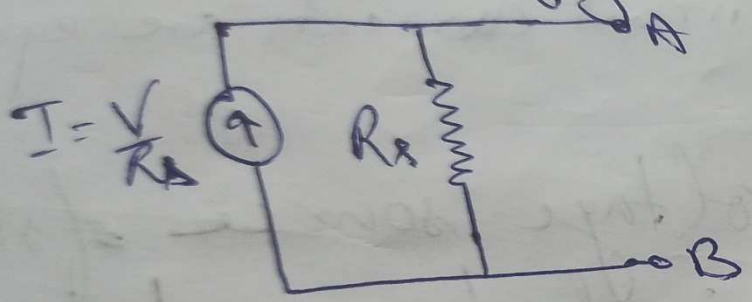
Source Transformation

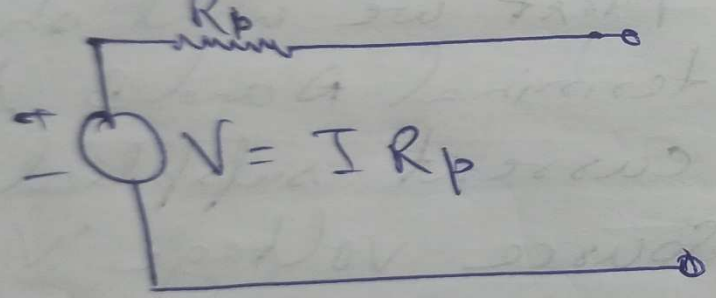
So the equivalent current source supplying this current $I = V/R_s$ and having the resistance R_s connected in ||rl with the current sourc as shown in figure below.



Next let us convert the given current source as shown below into it's equivalent voltage source.

Source Transformation

Let find the voltage across resistor R_p when AB is open circuit, this means current I will flow through resistor R_p. So the voltage V across the resistor R_p is $V = I R_p$. The equivalent voltage source and, a resistance R_p in series.



It should be noted that a voltage source-series resistance combination is equivalent to (or replaceable by) a current source-parallel

Source Transformation

Series resistance combination is equivalent to (or replaceable by) a current source-parallel resistance combination if only if their

1.) Respective open-circuit voltages are equal and
2.) Respective short-circuit currents are equal.

mple 1) Convert the voltage source shown in below figure to equivalent current source

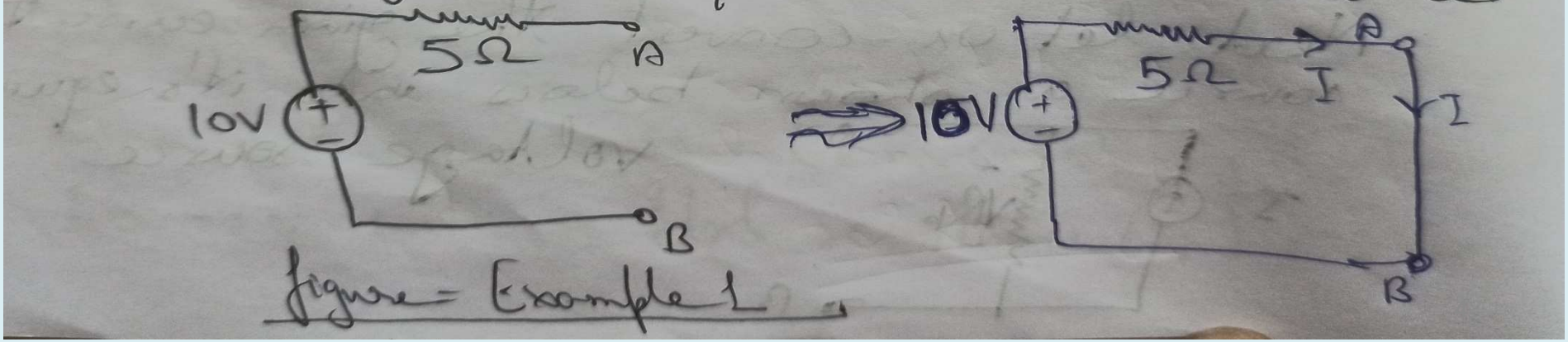


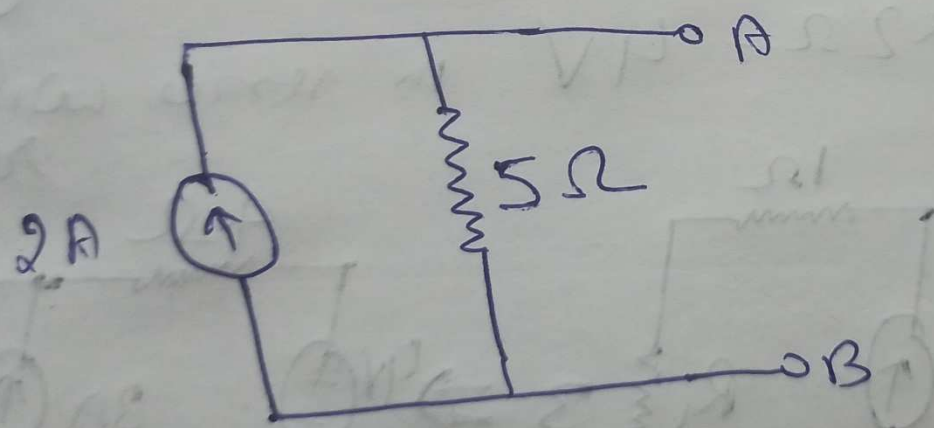
figure = Example 1

Source Transformation

Soln:- To convert to it's equivalent current source short the terminal AB, then finding the current 'I' through resistor 5 Ω.

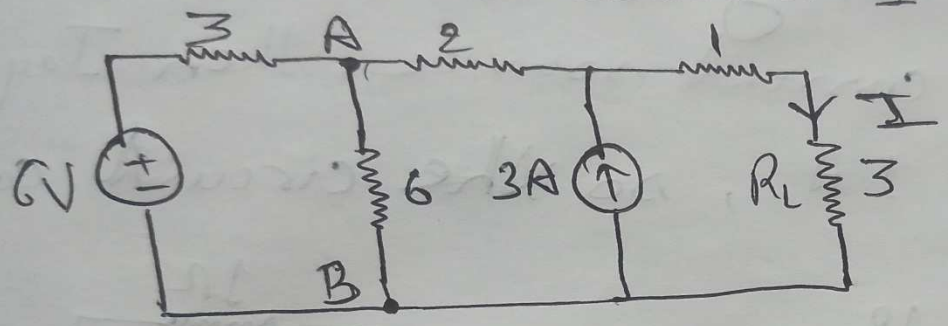
$$I_{5\Omega} = \frac{10V}{5\Omega} = 2A$$

So the equivalent current source with parallel resistance is shown below.



Source Transformation

Example 2) Use source conversion technique to find the load current I in the circuit Fig. below.

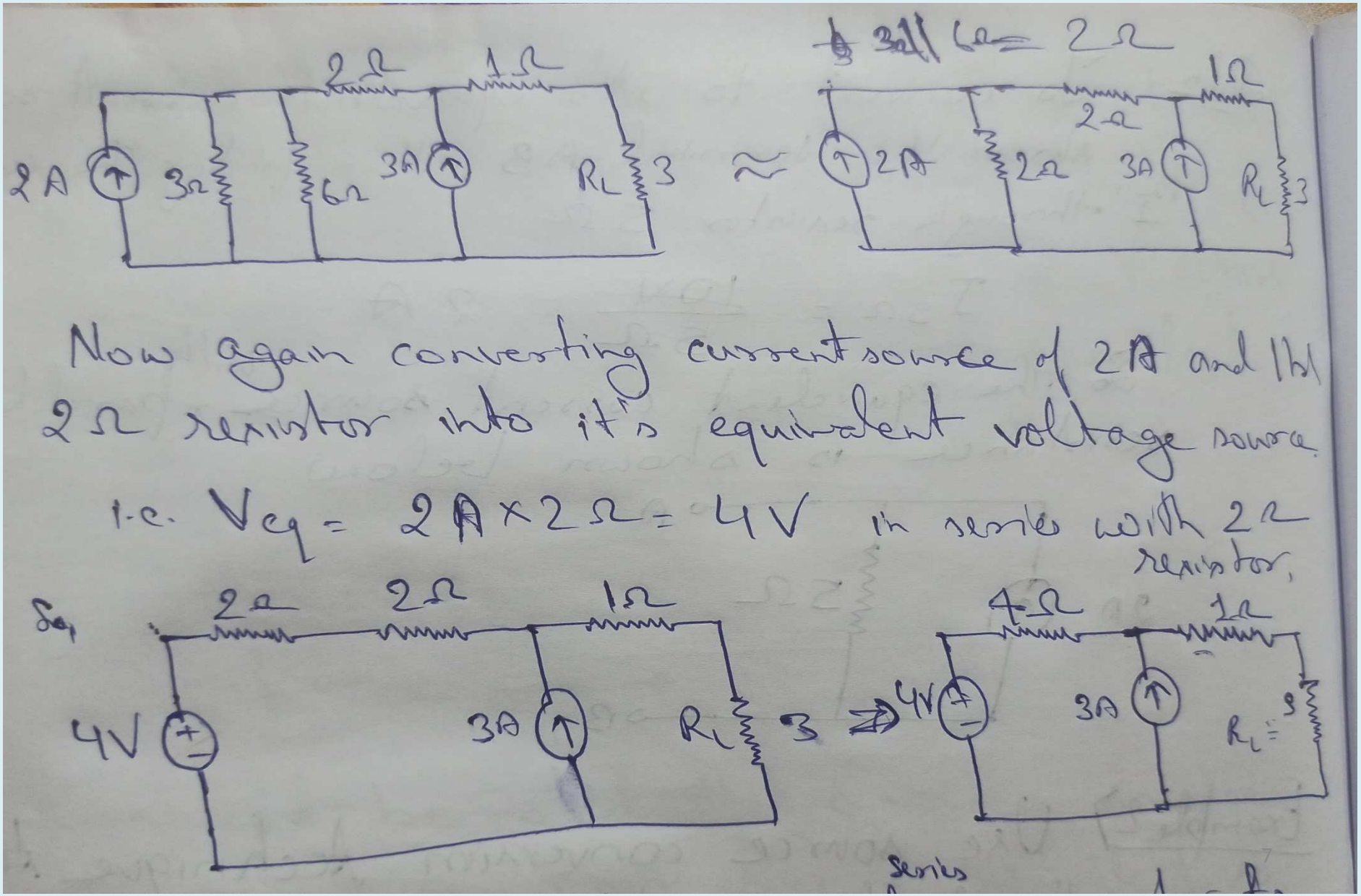


Sol:- To find the current 'I' through the load resistance R_L we use source transformation technique. Let us first convert 6 V voltage source and series 3 Ω resistor to its equivalent current source i.e.

$$I_s = \frac{6\,V}{3\,\Omega} = 2\,A$$

So ~~the equ~~ redrawing the network.

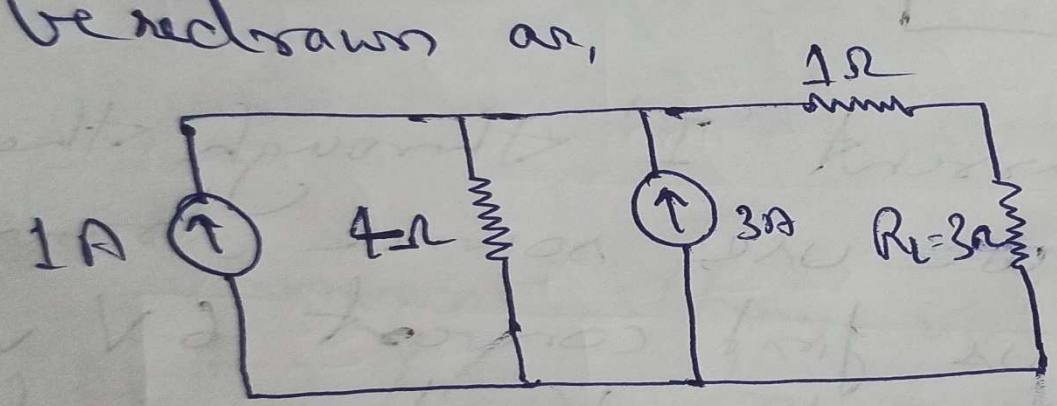
Source Transformation



Source Transformation

Now again converting 4V and 4Ω series to it's equivalent current source, then Ieq is

$I_{eq} = \frac{4V}{4\Omega} = 1A$, so the circuit can be redrawn as,



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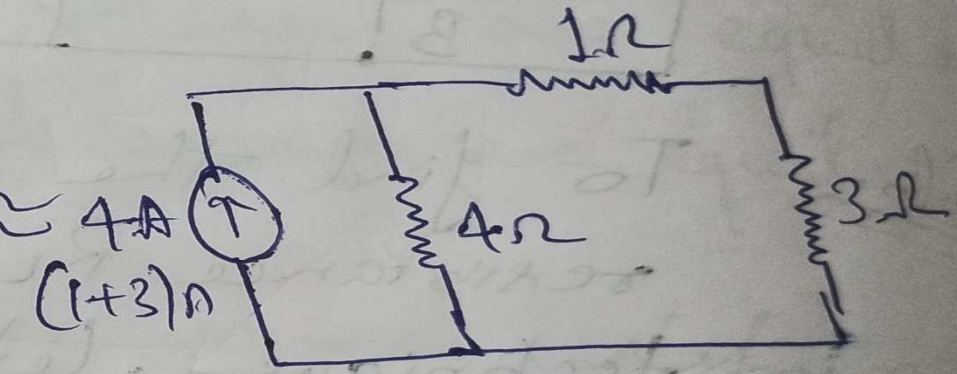
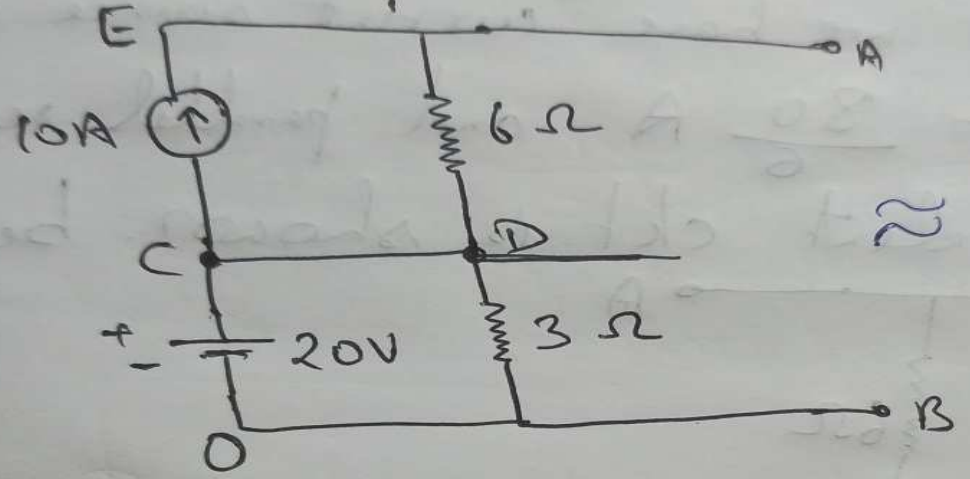


Now as 4Ω and (1+3)Ω are in ∥ol and both are equal so current of 4A divided equally in both branch. So the current (I) through load resistance R_L is = 2A

Source Transformation

Ex-2] Replace the given network by a single current source in parallel with a resistance.



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Soln:- In this case, the voltage-source has no resistive element in series. While handling such cases, the 3 Ω resistor has to be kept aside, treating it as an independent and seperate loop. This voltage source will circulate a current of $\frac{20}{3}$ A in the resistor and will not appear in the calculations.

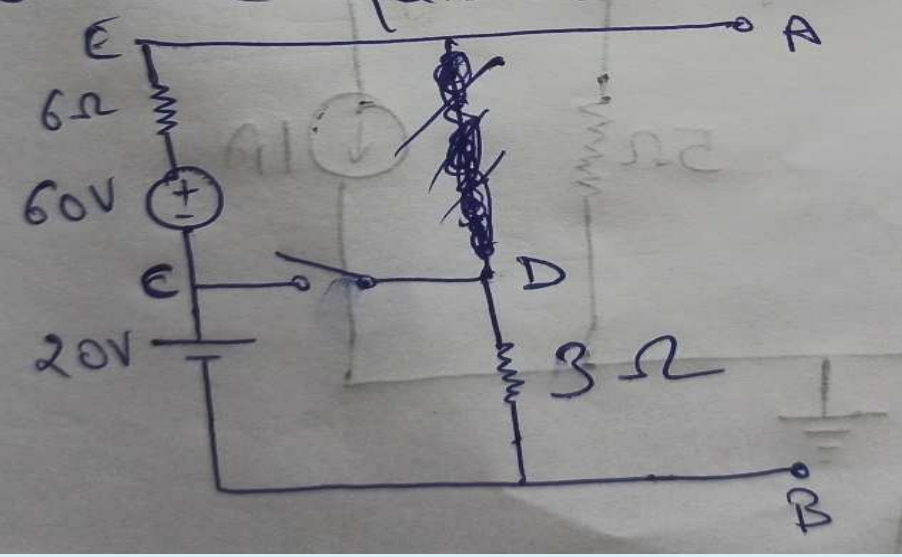
Source Transformation

This voltage source will circulate a current of $\frac{20}{3}$ A in the resistor and will not appear in the calculations.

The 10 A current source with parallel resistor of 6 Ω will 1st need to convert into voltage source with series resistance, so,

$V_1 = 10 \times 6 = 60\,V$

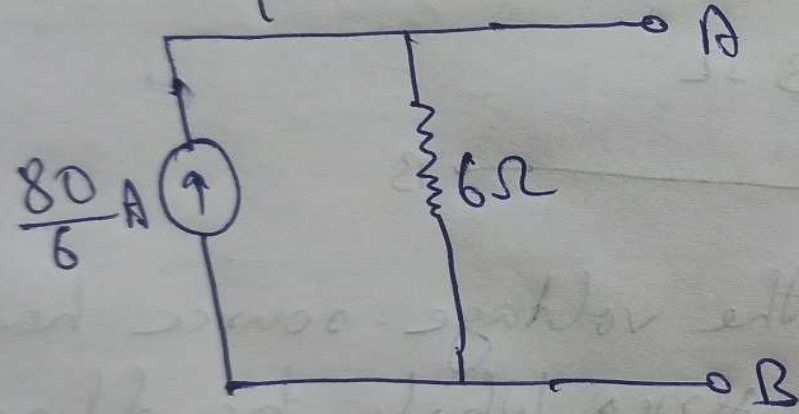
So the equivalent ckt. is



Now in this ckt 60V and 20 V are series with each other so effective voltage is 60 + 20 = 80 V in series with 3 Ω

Source Transformation

Converting 80 V voltage source in series with 6 Ω resistor we have current source with value → $I = \frac{80}{6}$ A and parallel resistance of 6 Ω and equivalent ckt is shown below.



So equivalent network with a single current ($\frac{80}{6}$ A) source in parallel with a resistance of value 6 Ω.

Source Transformation

Assignment Problem) Calculate the direction and magnitude of the current through the 5 Ω resistor between points A and B of Fig. 2.18 below using ~~nodal voltage~~ source transformation methods.

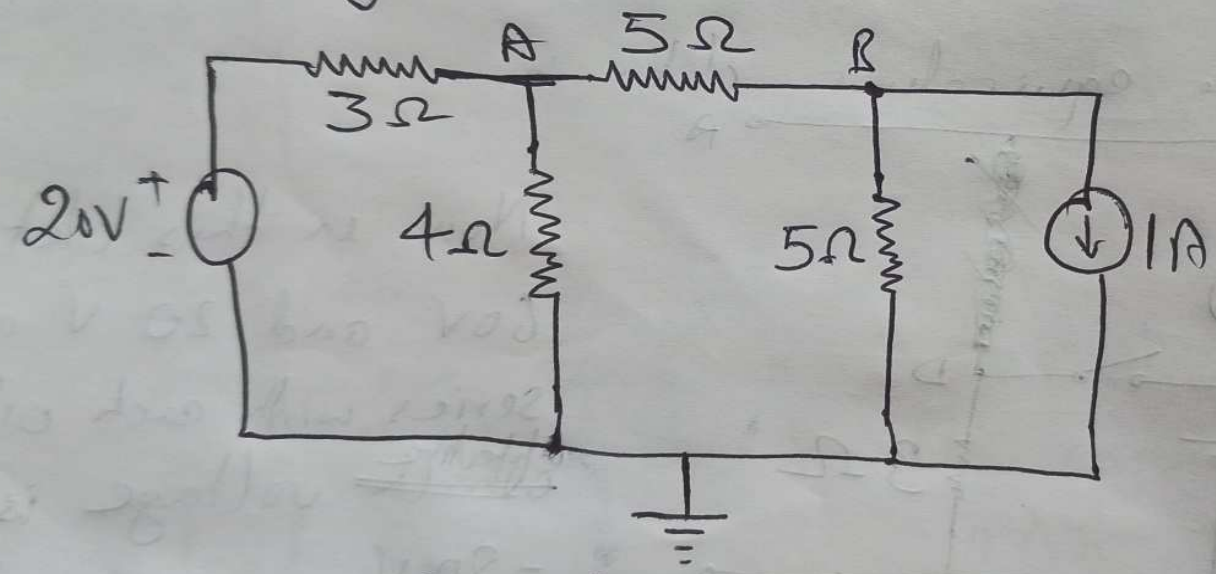


Fig A

Mesh and Nodal Analysis in Passive Circuits

For any query contact- 9771474020

Thank You