



ELEMENTS OF ELECTRICAL ENGINEERING

Course Code : UE25EE141A/B

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ELEMENTS OF ELECTRICAL ENGINEERING

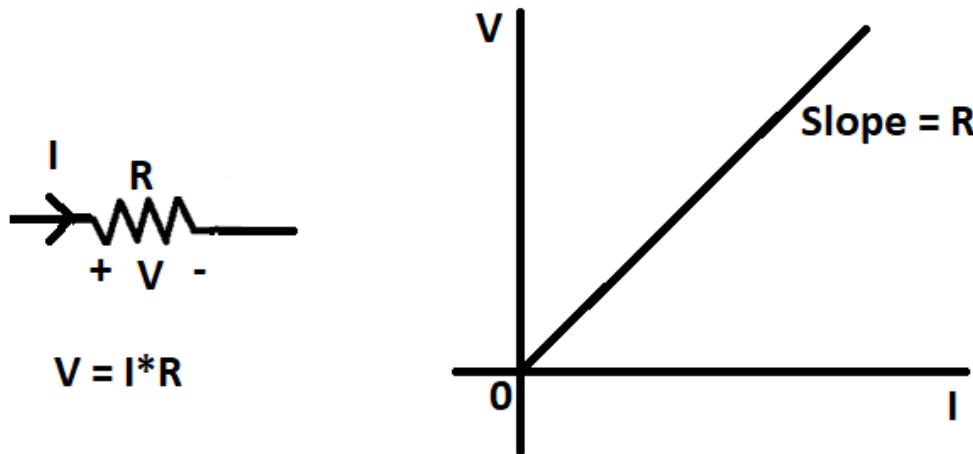
Concept of Linearity; Superposition Theorem

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A linear element is a passive element with linear voltage-current relationship.

Resistors, Inductors & Capacitors are linear elements.



A linear circuit is one which is composed of linear elements, independent sources & linear dependent sources.

Superposition Theorem - Statement

Superposition Theorem is applicable to Linear networks.

It can be stated as follows:

“In a linear network with more than one independent source, the total response in any element is the algebraic sum of the individual responses caused by each independent source acting alone, while all other independent sources are replaced by their internal resistances i.e., all other ideal voltage sources with short circuit and all other ideal current sources with open circuit.

”

Step 1: Consider one of the independent sources.

Step 2: Replace all other independent voltage sources with short circuit and all other independent current sources with open circuit.

Step 3: Find the individual response in the desired element due to the considered source acting alone.

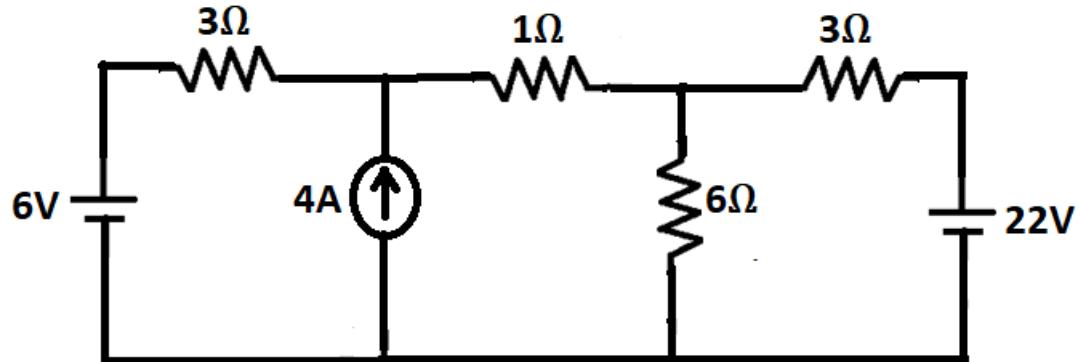
Step 4: Repeat Steps 1, 2 & 3 until all the sources are considered.

Step 5: Add all individual responses algebraically to get the total response.

Numerical Example 1

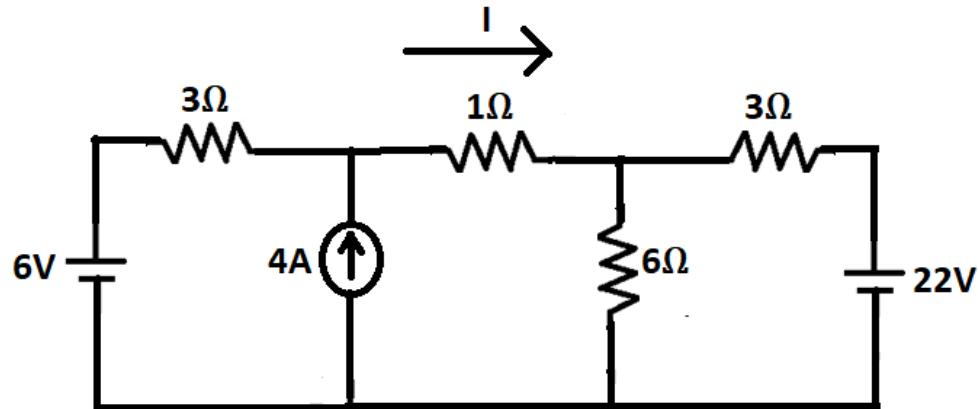
Question:

Obtain current through 1Ω resistor using Superposition Theorem.



Numerical Example 1

Solution:



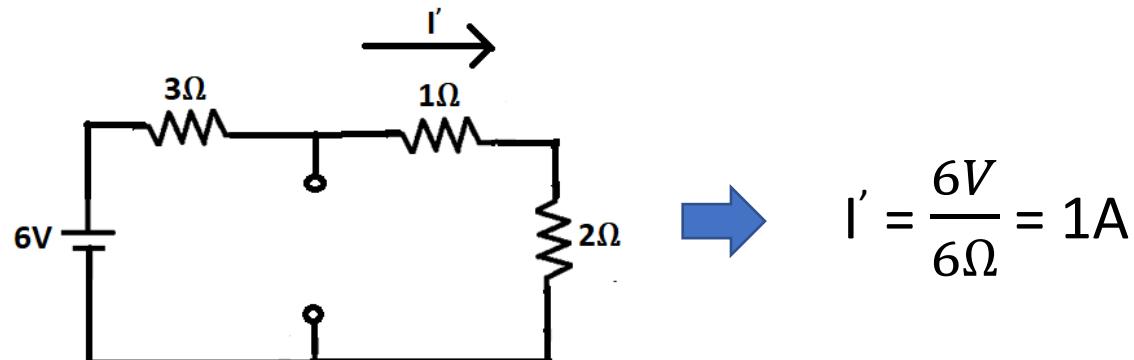
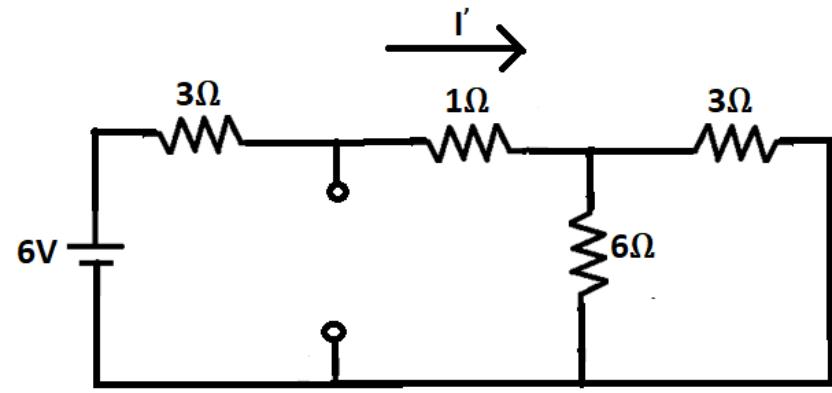
Let us consider individual response due to 6V source acting alone as I'

Let us consider individual response due to 4A source acting alone as I''

Let us consider individual response due to 22V source acting alone as I'''

Solution (Continued..) :

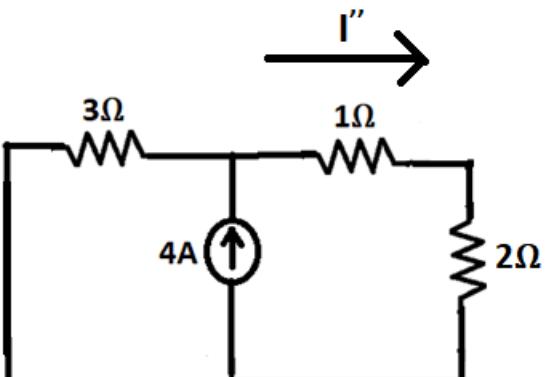
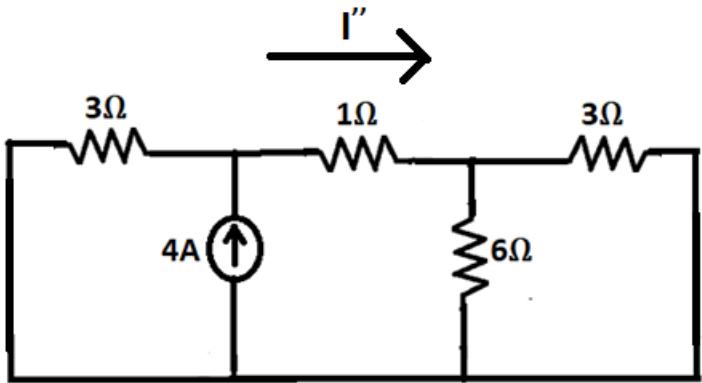
Considering 6V source alone,



$$I' = \frac{6V}{6\Omega} = 1A$$

Solution (Continued..) :

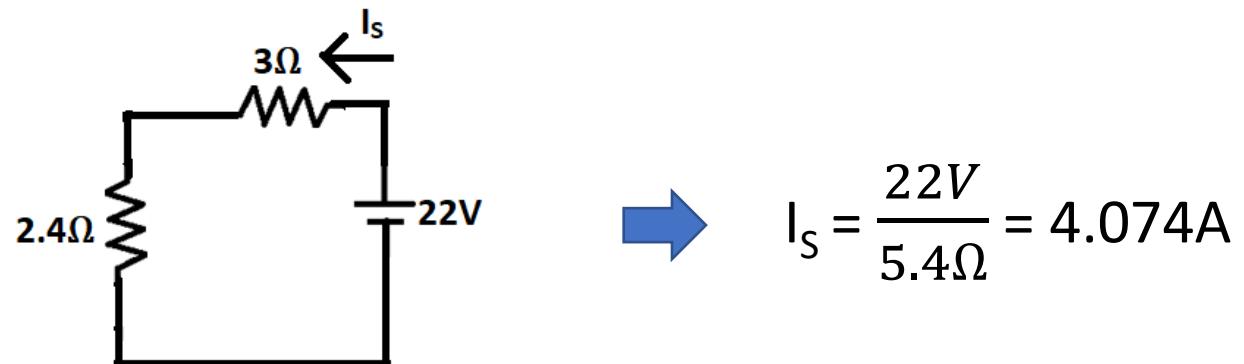
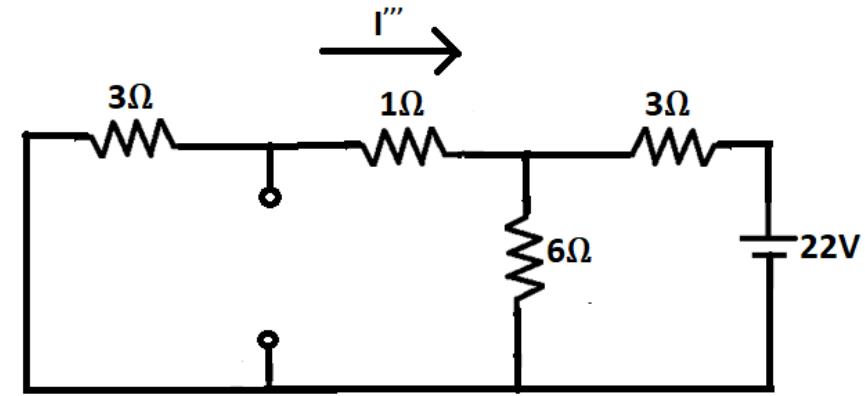
Considering 4A source alone,



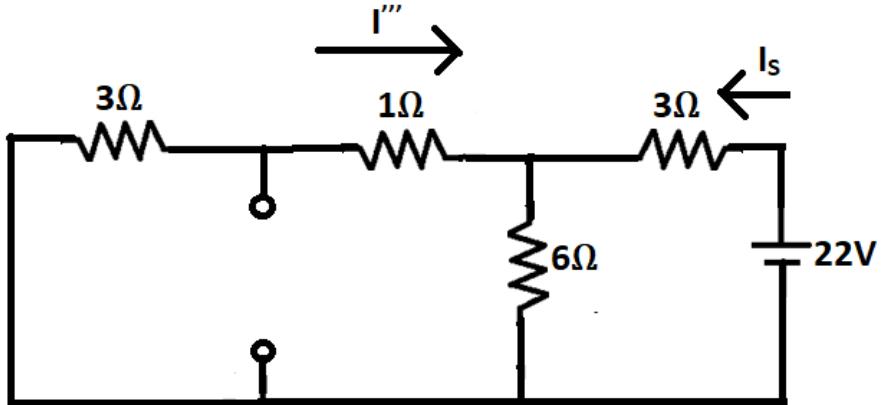
$$I'' = 4A * \frac{3\Omega}{6\Omega} = 2A$$

Solution (Continued..) :

Considering 22V source alone,



Solution (Continued..) :



$$I''' = -I_s * \frac{6\Omega}{10\Omega} = -2.44A$$

By Superposition Theorem,

$$I = I' + I'' + I'''$$

Hence, $I = 0.56A$

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshtha, 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.



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THANK YOU

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