ELEMENTS OF ELECTRICAL ENGINEERING

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Mesh Analysis

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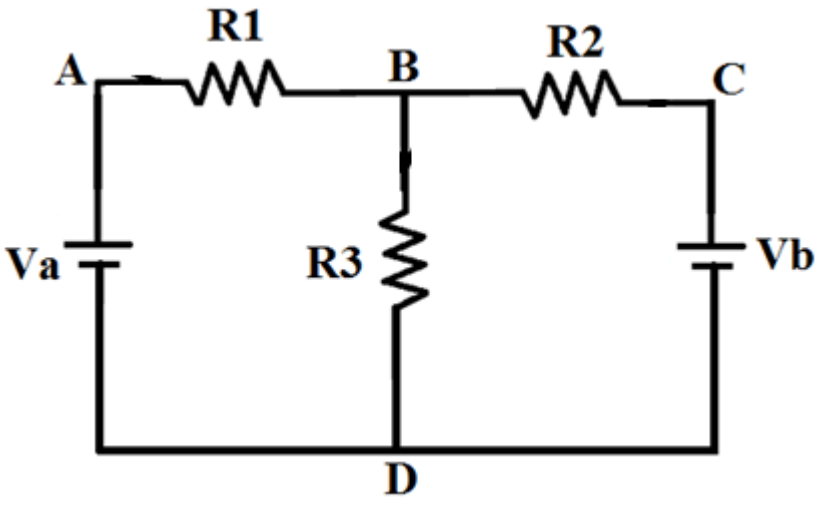
Concepts of Loop and Mesh

- A Loop is a closed path with current flow in every element in that path.
- A mesh is a fundamental loop. It doesn't have smaller loops within itself.



Loops:

A-B-D-A

B-C-D-B

A-B-C-D-A

Meshes:

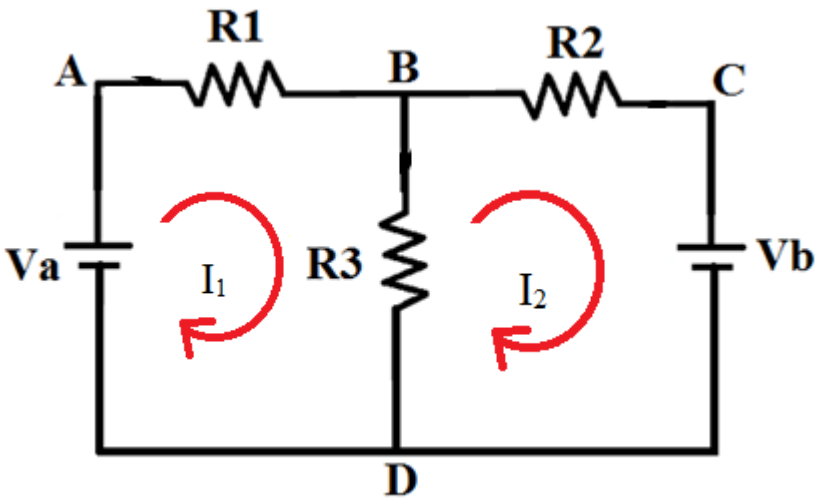
A-B-D-A

B-C-D-B

Steps to apply Mesh Analysis

Step 1: Identify the number of meshes in the network.

Step 2: Assign one mesh current in each mesh preferably in the same direction.



Step 3: Write KVL in every mesh.

Step 4: Solve simultaneous equations to obtain Mesh currents.

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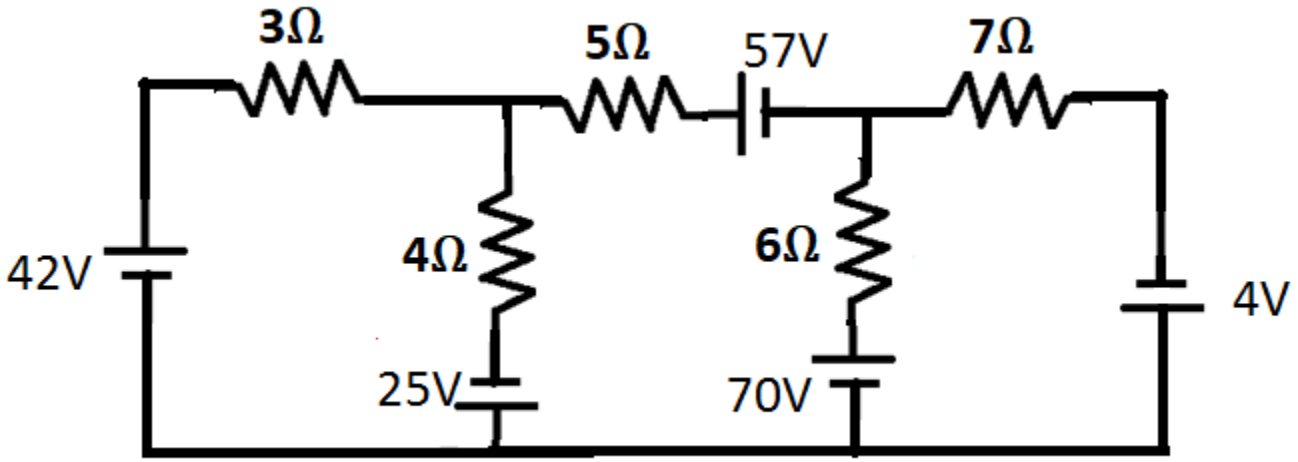
Mesh Analysis – Numerical Example

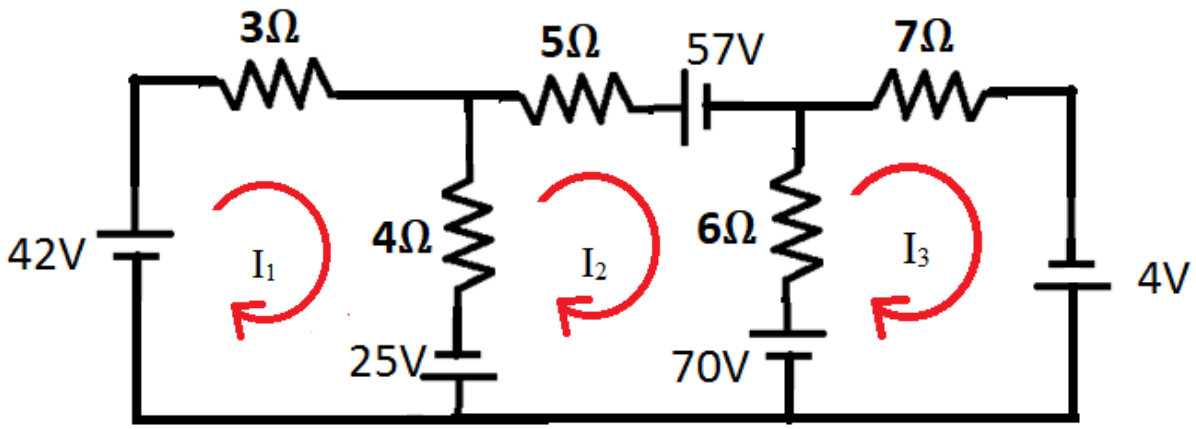
Question:

Obtain current through 6Ω resistor using Mesh Analysis.



Mesh Analysis – Numerical Example

Solution:



Number of Meshes = 3

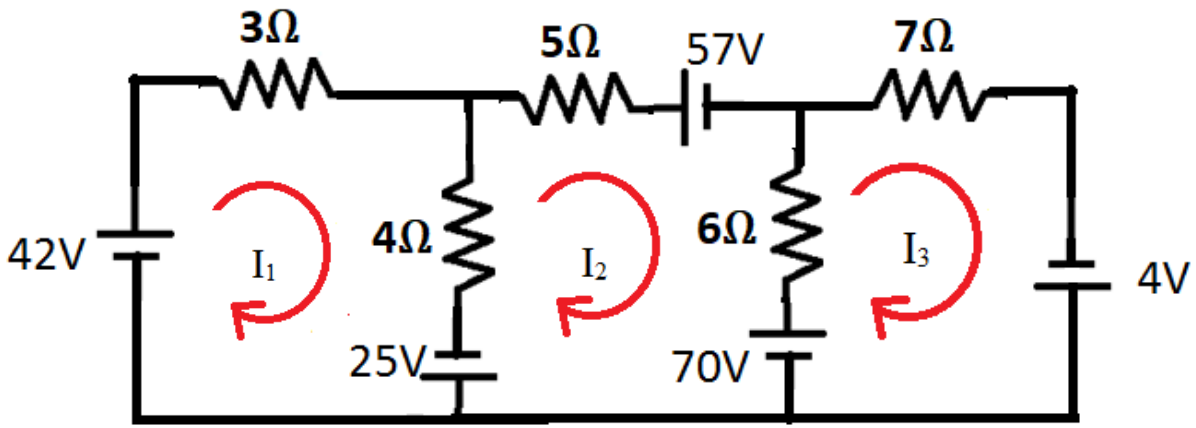
KVL (Mesh 1) : $-3I_1-4(I_1-I_2)+25+42 = 0$ ---- (1)

KVL (Mesh 2) : $-5I_2-57-6(I_2-I_3)-70-25-4(I_2-I_1) = 0$ ---- (2)

KVL (Mesh 3) : $-7I_3+4+70-6(I_3-I_2) = 0$ ---- (3)

Mesh Analysis – Numerical Example

Solution (Continued..):



Solving the simultaneous equations (1), (2) & (3),

$I_1 = 5A$; $I_2 = -8A$; $I_3 = 2A$

Current through 6Ω resistor = $(I_2 \sim I_3) = (I_3 - I_2) = 10A$

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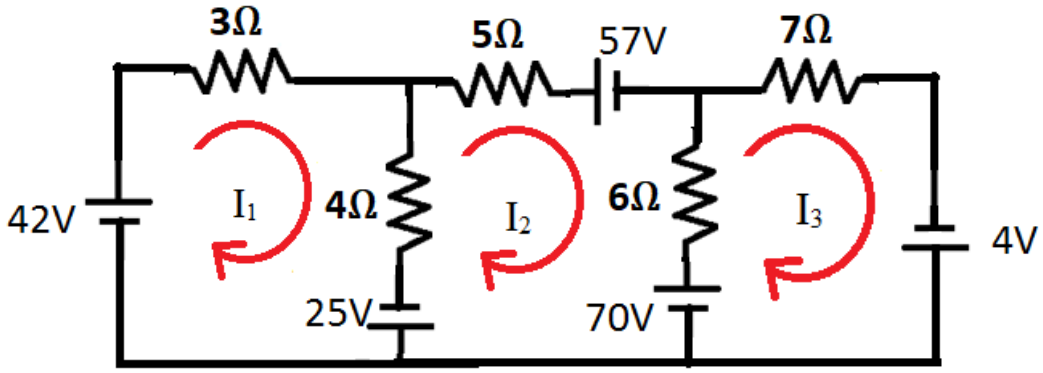
Mesh Analysis – Writing KVLs by Direct Inspection



- Coefficient of same mesh current = Sum of all resistances in that mesh.
- Coefficient of other mesh current = Negative of Sum of all common resistances between the meshes.

KVL (Mesh 1) : $7I_1-4I_2-0I_3 = +25+42$ ---- (1)

KVL (Mesh 2) : $-4I_1+15I_2-6I_3 = -57-70-25$ ---- (2)

KVL (Mesh 3) : $0I_1-6I_2+13I_3 = +4+70$ ---- (3)

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Text Book & References

Text Book:

"Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 11th Edition, Pearson Education, 2012.

Reference Books:

1. "Basic Electrical Engineering", K Uma Rao, Pearson Education, 2011.
2. "Basic Electrical Engineering - Revised Edition", D. C. Kulshreshta, Tata- McGraw-Hill, 2012.
3. "Engineering Circuit Analysis", William Hayt Jr., Jack E. Kemmerly & Steven M. Durbin, 8th Edition, McGraw-Hill, 2012.

THANK YOU

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