ELEMENTS OF ELECTRICAL ENGINEERING UE24EE141B

Vadhiraj K P P

Department of Electrical & Electronics Engineering

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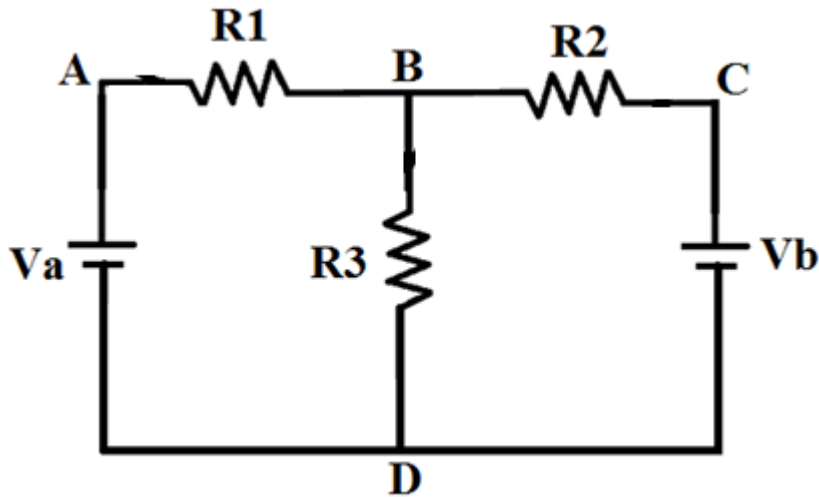
Lecture 11 - Mesh Analysis

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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.
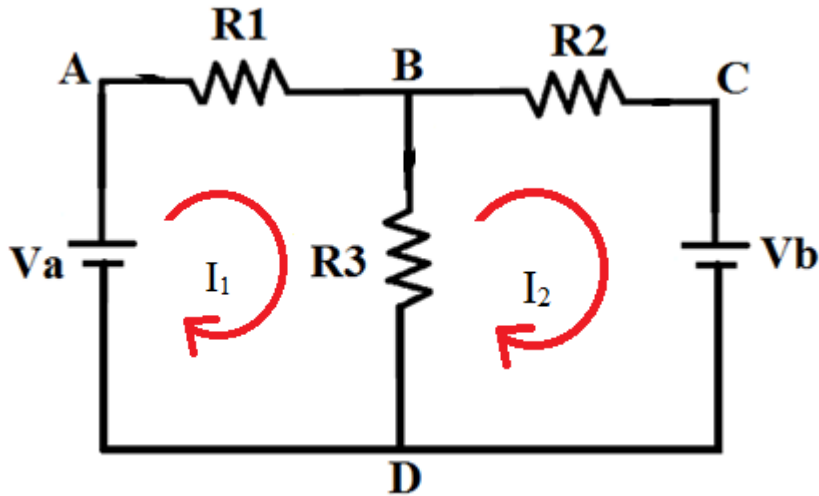

Loops:

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.

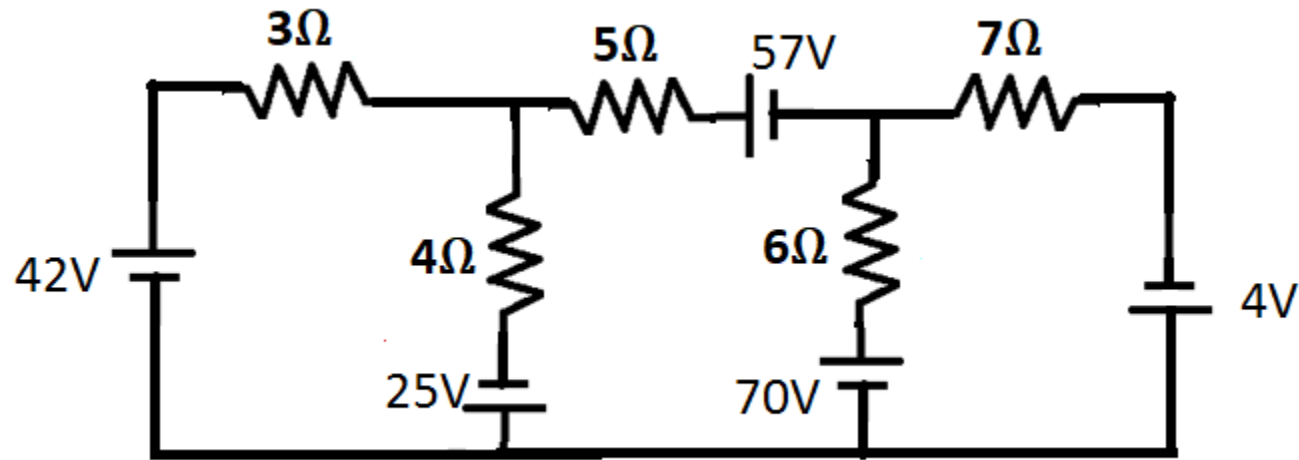Step 2: Assign one mesh current in each mesh preferably in the same direction.

Step 3: Write KVL in every mesh.

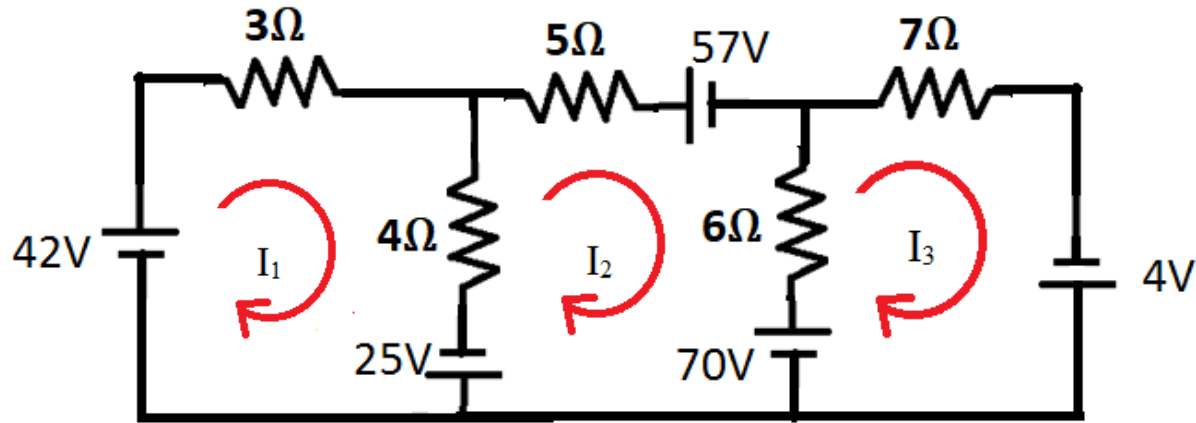Step 4: Solve simultaneous equations to obtain Mesh currents.

Question:

Obtain current through 6Ω resistor using Mesh Analysis.

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)
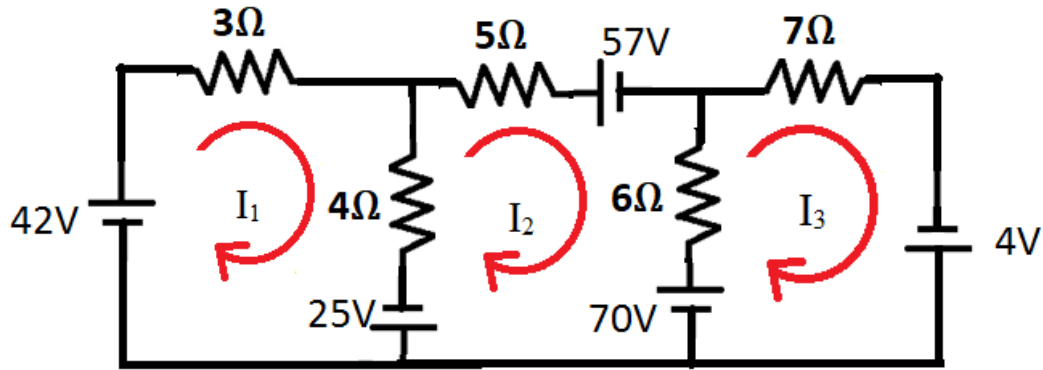
Solution (Continued..):
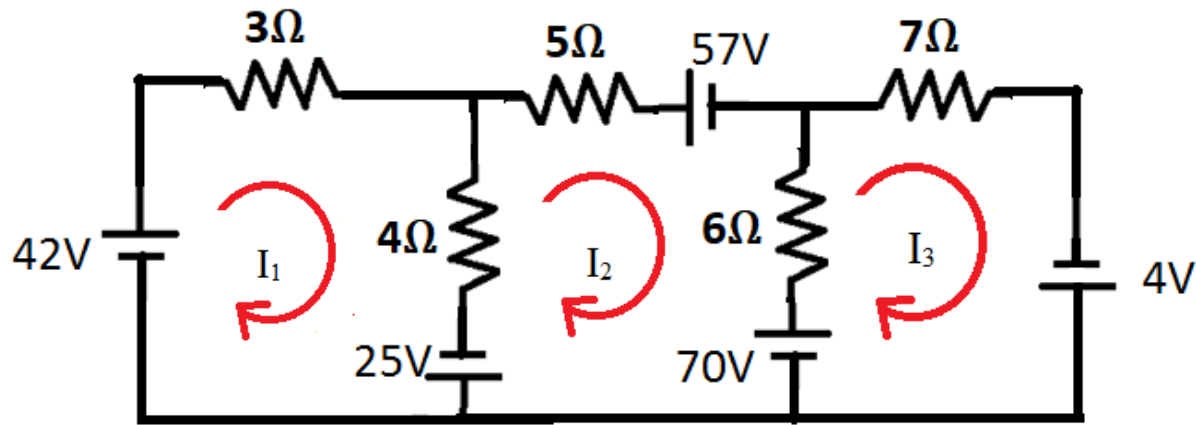
Solving the simultaneous equations (1), (2) & (3),

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

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

- 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)

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

Vadhiraj K P P

Department of Electrical & Electronics Engineering

vadhirajkpp@pes.edu