

## Module I: DC Circuits

6 Hrs

Basic circuit elements and sources; Ohms law, Kirchhoff's laws; Series and parallel connection of circuit elements; Source transformation; Node voltage analysis; Mesh current analysis; Maximum power transfer theorem

### CO1:

Evaluate DC and AC circuit parameters using various laws and theorems

### Module 1

Evaluate DC circuit parameters using various laws and theorems

# Mesh analysis

Mesh is a loop that does not contain any other loop within it.

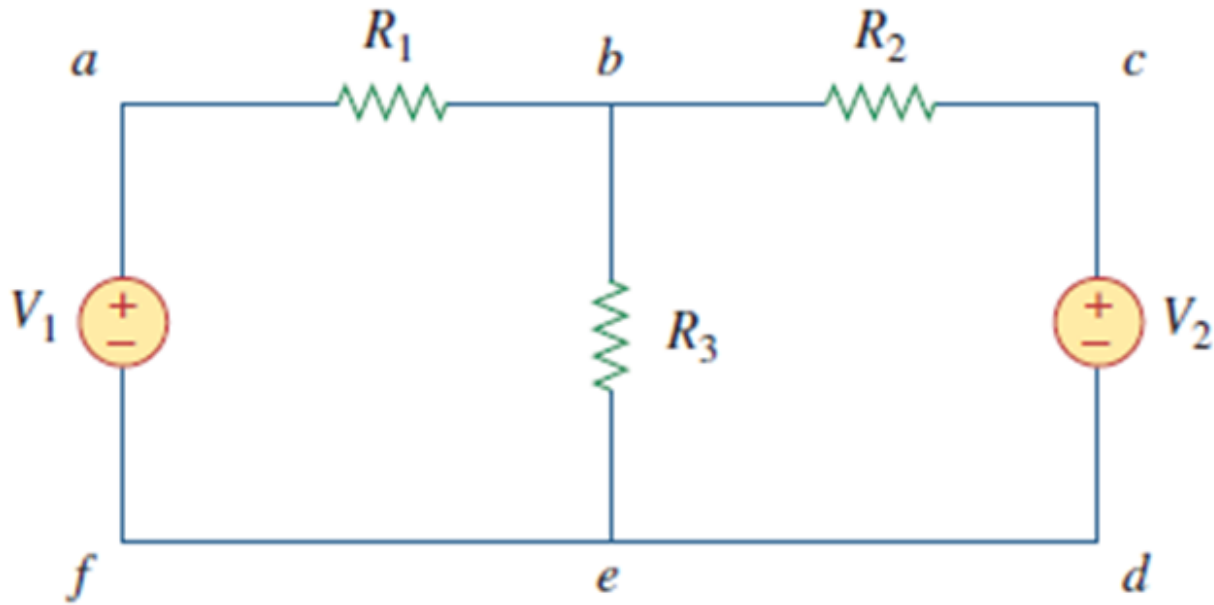
- Mesh currents as the circuit variables
  - Reduces the number of equations
- KVL is applied to find unknown currents
- Loop analysis or mesh current method

# Steps

- Assign mesh currents  $i_1, i_2, i_3, \dots, i_n$  to the  $n$  meshes.
- Apply KVL to each of the  $n$  meshes. Use Ohm's law to express the voltages in terms of mesh currents.
- Solve the resulting simultaneous equations to get the mesh currents.

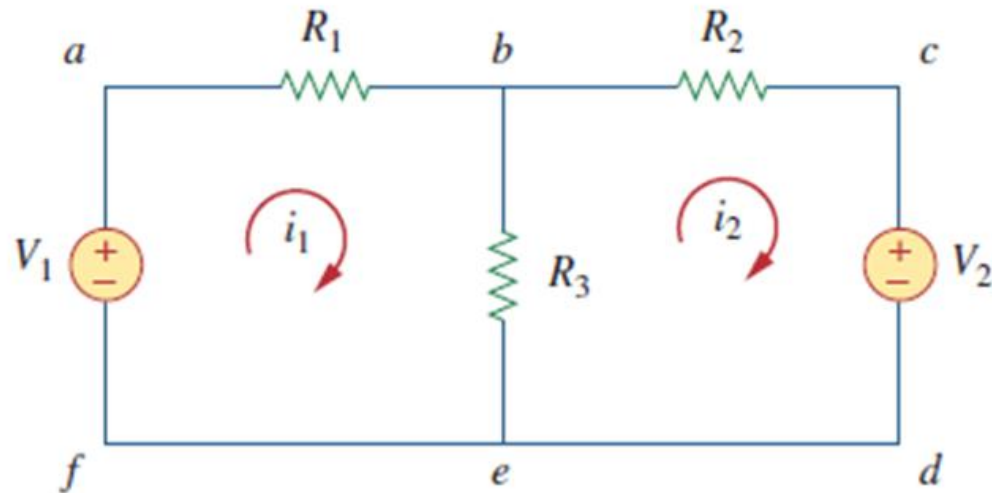
# Illustration

## Determine the mesh currents



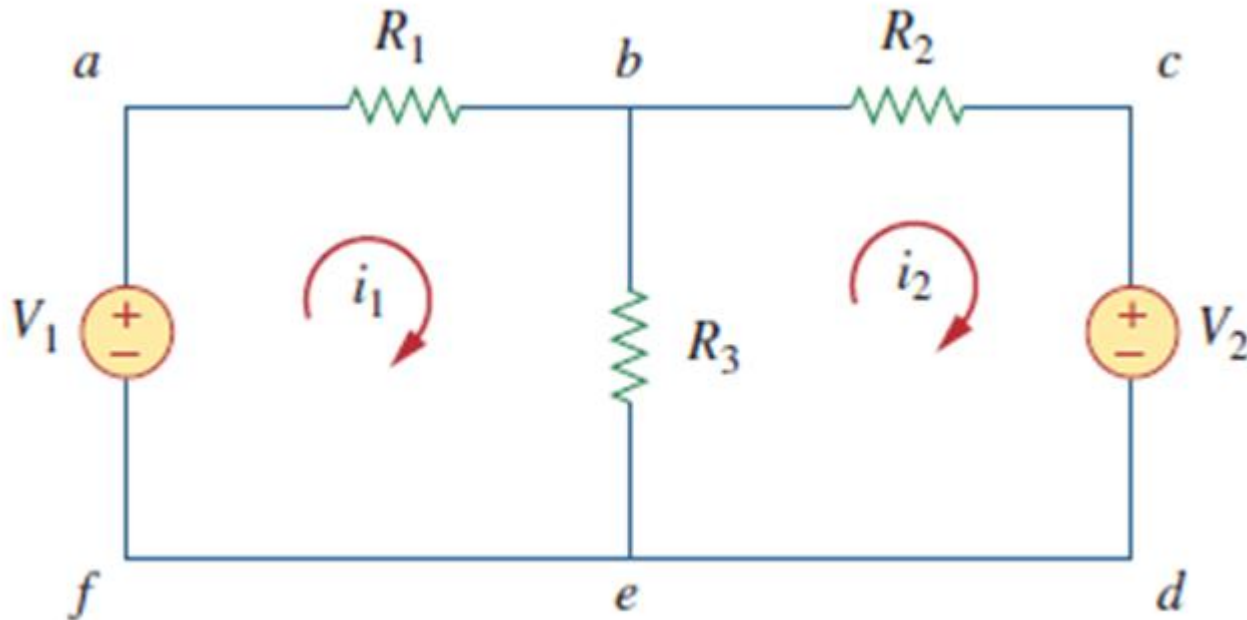
# Step 1

- Assign mesh currents  $i_1$  and  $i_2$  to meshes 1 and 2
- It is conventional to assume clockwise direction



## Step 2

Apply KVL to each mesh

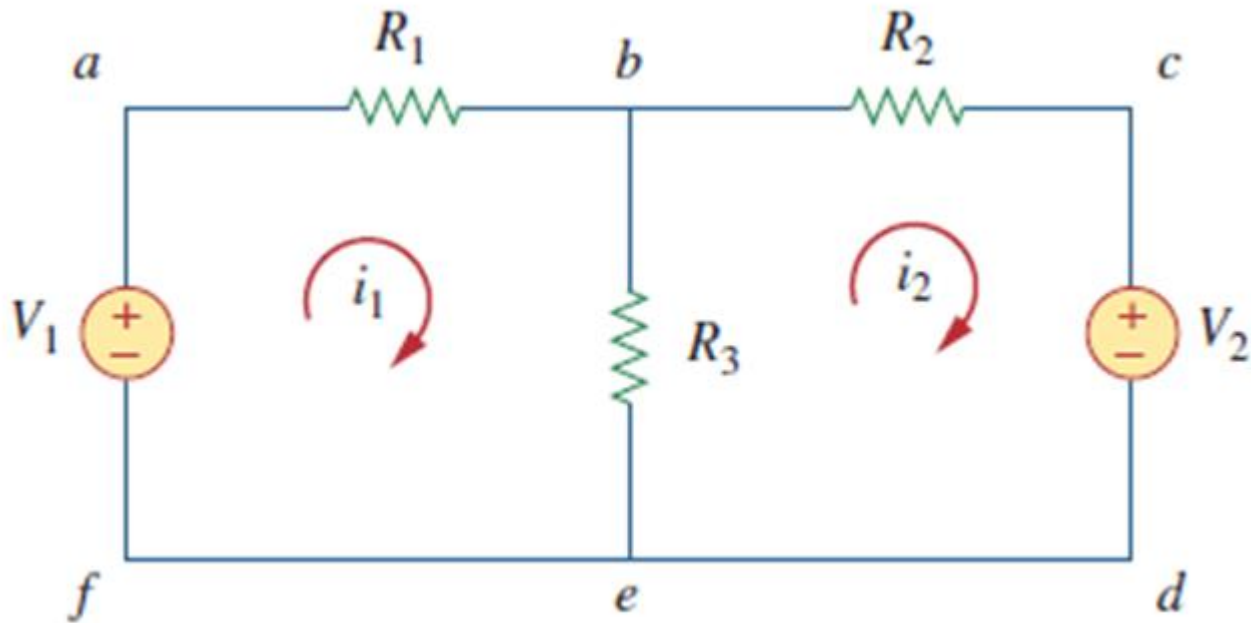


$$(R_1 + R_3)i_1 - R_3i_2 = V_1$$

$$-R_3i_1 + (R_2 + R_3)i_2 = -V_2$$

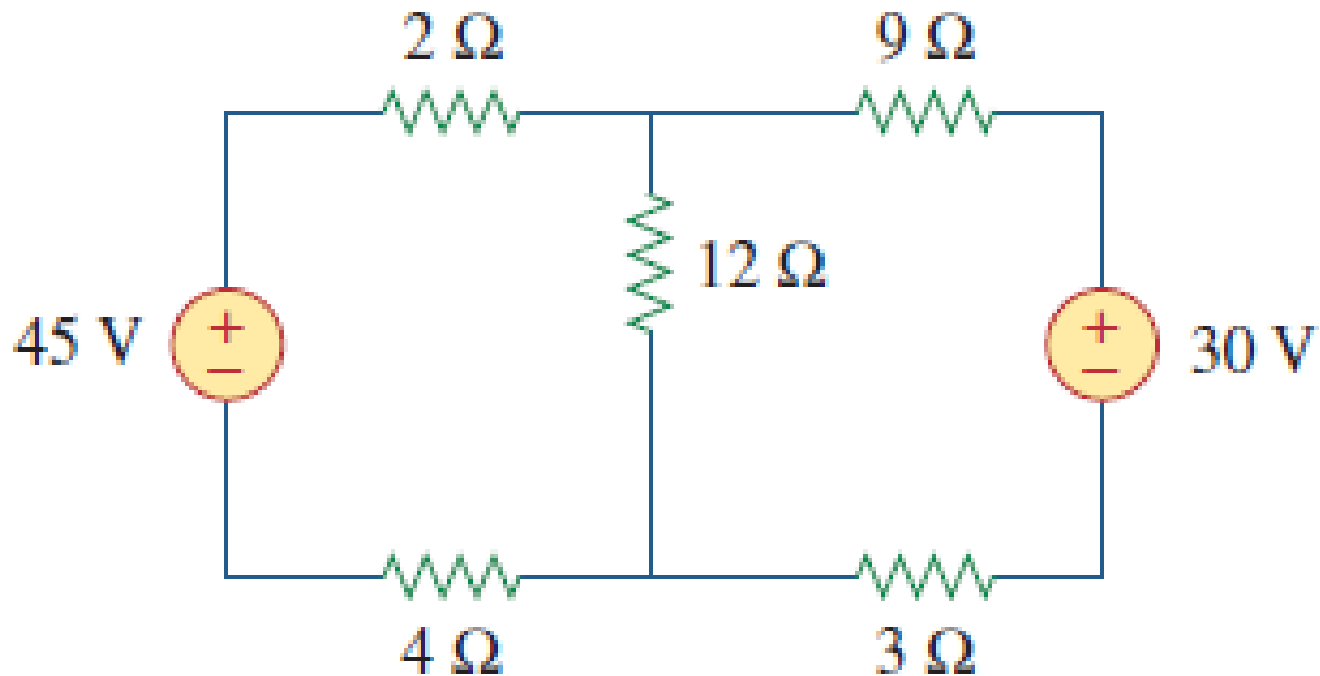
# Step 3

Solve the simultaneous equations



# Example 1

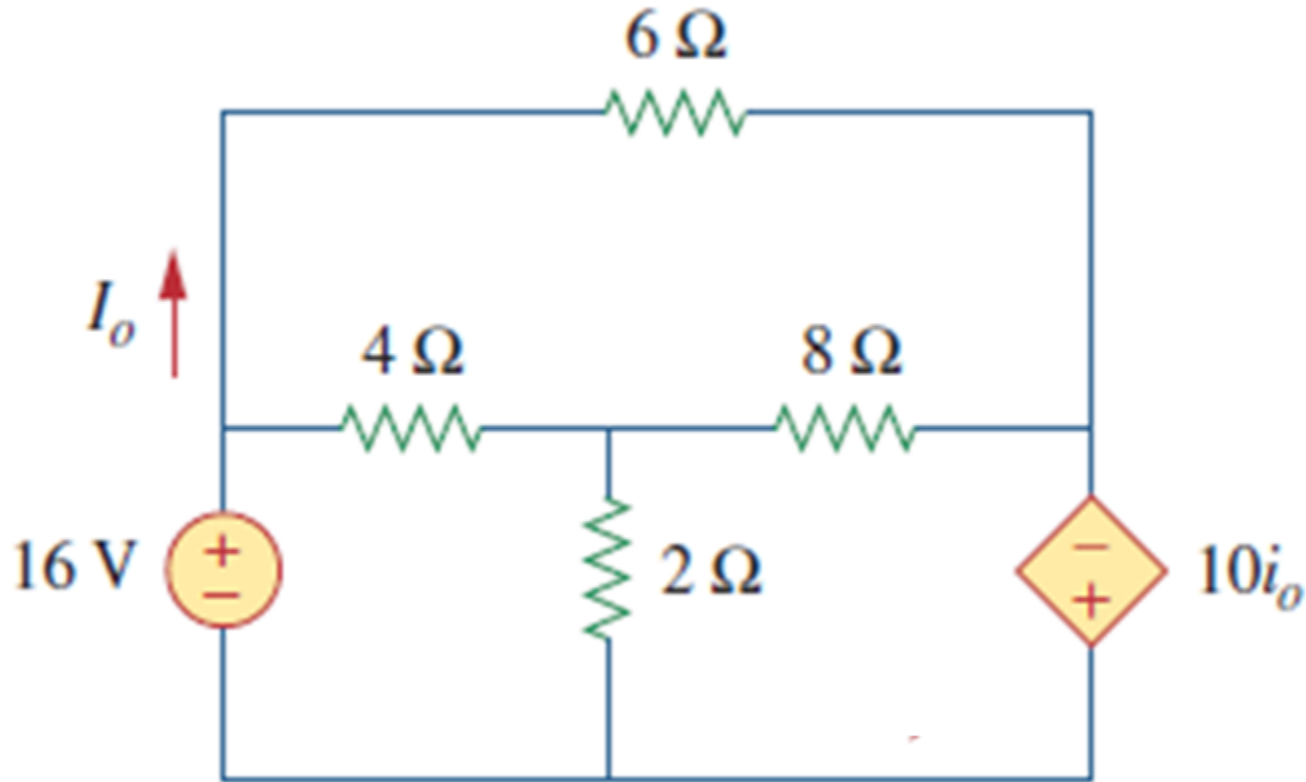
Find  $i_1$  and  $i_2$  using mesh analysis





## Example 2

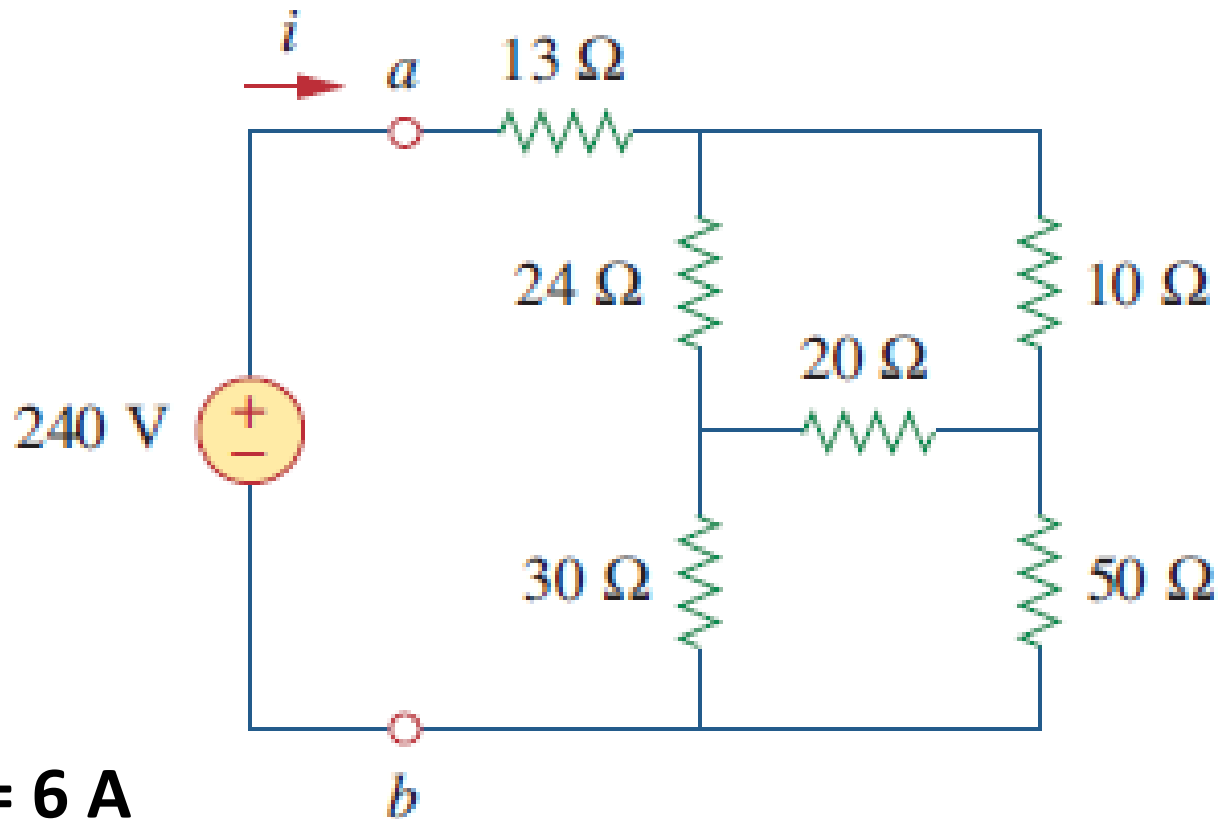
Find  $i_o$  using mesh analysis



**Ans:  $i_o = -4$  A**

# Exercise 1

Determine the current supplied by the source using mesh analysis



**Ans:  $i = 6$  A**