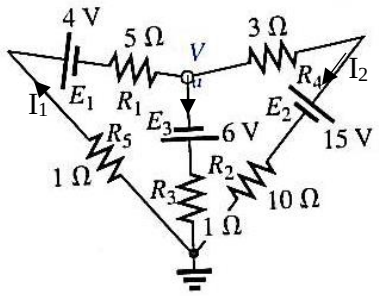
Q- Using mesh analysis determine the current through 5Ω resistor and voltage V in the given network.



Let the clockwise currents are I_1 and I_2 as in figure. The current through R3 will be $I_1 - I_2$.

Considering the loop on the left and applying Kirchhoff's law we get

$\Sigma E = \Sigma IR$

Or $- E_1 + E_3 = I_1 (R_1 + R_5) + (I_1 - I_2)*R_3$

Or $- 4 + 6 = 6\ I_1 + 1*(I_1 - I_2)$

Or $7\ I_1 - I_2 = 2$ ---------- (1)

Considering the loop on the right and applying Kirchhoff's law we get

$\Sigma E = \Sigma IR$

Or $- E_2 - E_3 = I_2 (R_4 + R_2) - (I_1 - I_2)*R_3$

Or $- 15 - 6 = 13\ I_2 + 1*(I_1 - I_2)$

Or $I_1 - 12\ I_2 = - 21$ ---------- (2)

(1)*12 – (2) gives

$83\ I_1 = 45$

Or $I_1 = 45/83 =$ **0.542 A**

And $I_2 = 7\ I_1 - 2 = 7*0.542 - 2 =$ **1.794 A**

Hence current through 5 W resistor is **0.542 A**

And the voltage Va will be given by considering the central arm as

$Va = - E_3 - (I_1 - I_2)*R_3 = -6 - (0.542 - 1.794)*1 =$ **- 4.748 V**