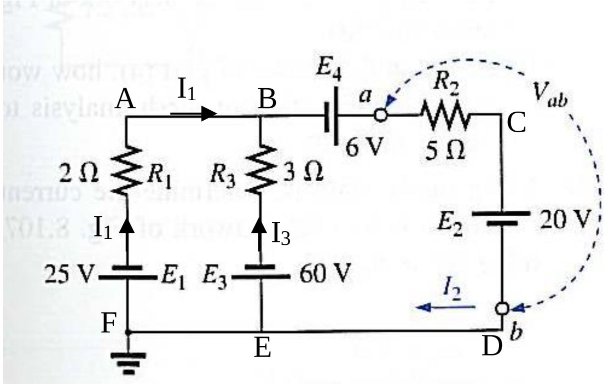
Q- Find the mesh currents and voltage V_{ab} for given network.



(I)

Let the currents in the different branches are as indicated in figure.

Considering the junction law for nod B we get

$I_1 - I_2 + I_3 = 0$

Or $\quad I_3 = I_2 - I_1$ ------------------ (1)

Considering mesh ABEFA (clockwise positive) we have

$\Sigma E = E_3 - E_1$

And $\quad \Sigma IR = I_1R_1 - I_3R_3$

Applying Kirchhoff's law we have

$\Sigma E = \Sigma IR$

Or $\quad E_3 - E_1 = I_1R_1 - I_3R_3$

Or $\quad 60 - 25 = 2\, I_1 - 3\, I_3$

Or $\quad 2\, I_1 - 3\, I_3 = 35$ ------------- (2)

Considering mesh BCDEB (clockwise positive) we have

$\Sigma E = E_4 - E_2 - E_3$

And $\quad \Sigma IR = I_2R_2 + I_3R_3$

Applying Kirchhoff's law we have

$\Sigma E = \Sigma IR$

Or $\quad E_4 - E_2 - E_3 = I_2R_2 + I_3R_3$

Or $\quad 6 - 20 - 60 = 5\, I_2 + 3\, I_3$

Or $\quad 5\, I_2 + 3\, I_3 = -\,74$ ------------- (3)

Substituting values of I_3 in equations 2 and 3 in equation 1 we get

$2\, I_1 - 3\,(I_2 - I_1) = 35$

Or $\quad 5I_1 - 3\, I_2 = 35$ ------------- (2A)

And $\quad 5\, I_2 + 3\,(I_2 - I_1) = -\,74$

Or $\quad -\,3I_1 + 8\, I_2 = -\,74$ ------------- (3A)

Equation (2A)*3 + (3A)*5 gives

$31\ I_2 = -\ 265$

Or $I_2 = -\ 265/31 = -\ 8.55$ A

Using equation (2A) we have

$5I_1 - 3(-\ 8.55) = 35$

Gives **$I_1 = 1.87$ A**

And $I_3 = I_2 - I_1 = -\ 8.55 - 1.87 =$ **$-\ 10.42$ A**

Now $V_{ab} = V_a - V_b$ = potential drop across R_2 and across E_2

Or $V_{ab} = I_2R_2 - E_2 = -\ 8.55*5 - (-20) =$ **$-\ 22.75$ V**