Q- Find the mesh currents and the voltage V_{ab} for the given network. The source is the current source supplying a current of 3 A.

Considering the node f we get the current in R_1 as $I_2 - I_1$ and considering node e the current through R_4 is $I_2 - I_3$.

For mesh abefa we get (clockwise)

$\Sigma E = E_2 = 6$ V

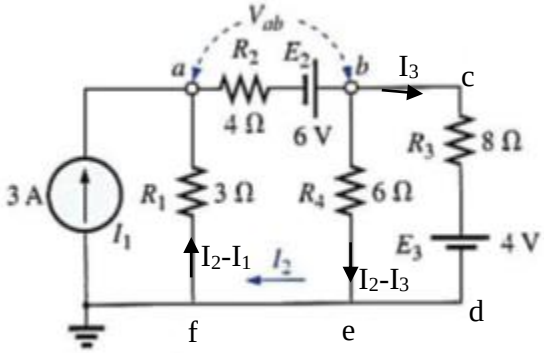
And $\Sigma IR = (I_2 - I_3)R_4 + (I_2 - I_1)R_1 + I_2R_2$

Applying loop law for the mesh we get

$(I_2 - I_3)R_4 + (I_2 - I_1)R_1 + I_2R_2 = 6$

Or $4\ I_2 + 6\ (I_2 - I_3) + 3\ (I_2 - 3) = 6$

Or $13\ I_2 - 6\ I_3 = 15$ ---------- (1)



For mesh bcdeb

$\Sigma E = E_3 = -4$

And $\Sigma IR = I_3R_3 - (I_2 - I_3)\ R_4$

Hence by loop law

$I_3R_3 - (I_2 - I_3)\ R_4 = -4$

Or $8\ I_3 - 6\ (I_2 - I_3) = -4$

Or $6\ I_2 - 14\ I_3 = 4$

Or $3\ I_2 - 7\ I_3 = 2$ ---------- (2)

Now equation (1)*3 – equation(2)*13 gives

$73\ I_3 = 19$

Or $I_3 = 19/73$ A = **0.26 A**

Substituting in (2)

$I_2 = (2 + 7*2.6)/3$ = **1.274 A**

And the potential difference Vab is given by

$V_{ab} = I_2R_2 + E_2 = 1.274*4 + 6$ = **11.096 V**

www.physicshelpline.com