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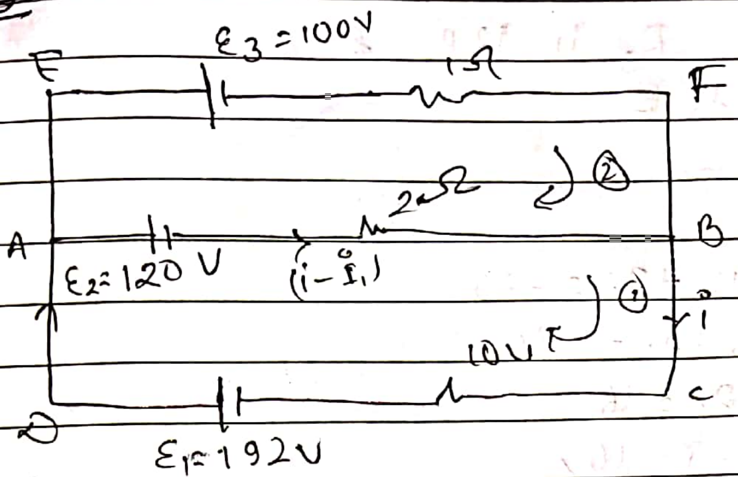
BCT-A 019

classmate
Date
Page

Q.N.1



→ Soln,

In loop 1st

$$-10i + 192 - 120 - 2(i - i_1) = 0$$
$$\text{or} \quad -10i + 72 - 2i + 2i_1 = 0$$
$$\text{or} \quad -12i + 2i_1 = -72 \quad \text{—(i)}$$

In 2nd loop

$$-100 - i_1 + 2(i - i_1) + 120 = 0$$
$$-100 - i_1 + 2i - 2i_1 + 120 = 0$$
$$-3i_1 + 2i = -20 \quad \text{—(2)}$$

now,

$$-12i + 2i_1 = -72$$
$$12i - 18i_1 = -120$$

$$-16i_1 = -192$$

$$i_1 = \frac{+192}{+16}$$

$$= 12\,A$$

So,

current in E_3 is 12 A &
from E to F

Also,

$$-3 \times 12 + 2i = -20$$
$$-36 + 2i = -20$$
$$2i = 16$$
$$i = 10/2$$
$$= 8\,A$$

So,

current in E_1 is 8 A from C to D

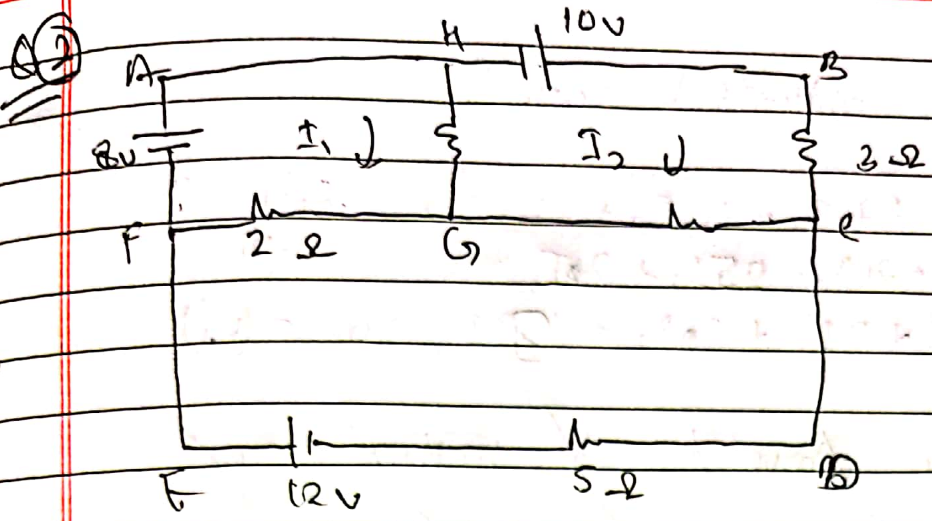
again,

$$I - i_1 = -12 + 8 = -4A$$

$i_1 = \cancel{-4A}$ (so, assumed direction is wrong)

Current in E_2 is 4 A from B to A.

Q2



⇒ Solⁿ,

In mesh AHGFA (I)

$8 - 20(I_1 - I_2) - 2(I_1 - I_3) = 0$

$8 - 20I_1 + 20I_2 - 2I_1 + 2I_3 = 0$

$8 - 22I_1 + 20I_2 + 2I_3 = 0$ — (i)

In mesh HBCG (II)

$10 - 3I_2 - 20(I_2 - I_3) - 20(I_2 - I_1) = 0$

$10 - 3I_2 - 20I_2 + 20I_3 - 20I_2 + 20I_1 = 0$

$10 - 23I_2 + 20I_3 + 20I_1 = 0$ — (2)

In mesh FGCDF

$-2(I_3 - I_1) - 20(I_3 - I_2) - 5(I_3) + 12 = 0$

$-2I_3 + 2I_1 - 20I_3 + 20I_2 - 5I_3 + 12 = 0$

~~$12 - 27I_3 + 20I_2 + 2I_1 = 0$ — (3)~~

$12 + 2I_1 + 2I_2 - 9I_3 = 0$ — (3)

Now,

the obtained equation

$$8 - 27 I_1 + 20 I_2 + 2 I_3 = 0 \quad \text{—(i)}$$
$$10 + 20 I_1 - 25 I_2 + 20 I_3 = 0 \quad \text{—(ii)}$$
$$12 + 2 I_1 + 20 I_2 - 9 I_3 = 0 \quad \text{—(iii)}$$

~~writing above eq^n in matrix form~~

$$\begin{bmatrix} -22 & 20 & 2 \\ 20 & -43 & 20 \\ 2 & 20 & -27 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} -8 \\ -10 \\ -12 \end{bmatrix}$$

Solving eq^n (i), (ii) & (iii)

$$I_1 = 4.678 A$$
$$I_2 = 4.411 A$$
$$I_3 = 3.353 A$$

$\therefore$ current in 5Ω resistor is 3.353 A.

Test - 1 [DC - Portion]

Q. 3

$R_1 = 800\,\Omega$ $\quad R_2 = 400\,\Omega$

$\alpha_1 = 0.02/^\circ C$ $\quad \alpha_2 = 0.04/^\circ C$

=> Soln,

for coil 1;

$R_{60} = R_{30}(1 + \alpha_{30}(60-30))$

$= 800(1 + 0.02 \times 30)$

$= 1280\,\Omega$

For coil 2 :

$R_{60} = R_{30}(1 + \alpha_{30}(60-30)]$

$= 400[1 + 0.04 \times 30]$

$= 880\,\Omega$

i) resistance of combination at 60°C

$R_{60} = 1280 + 880$

$= 2160\,\Omega$

ii) $R_{30}(com) : 800 + 400 = 1200\,\Omega$

$\therefore R_{60}(comb) = R_{30(comb)}[1 + \alpha_{30(comb)}(60-30)]$

$\Rightarrow 2160 = 1200[1 + \alpha_{30}(combo) \times 30]$

$\Rightarrow 1.8 = 1 + \alpha_{30(combo)} \times 30$

$\Rightarrow 0.8 = \alpha_{30(combo)} \times 30$

$\therefore \alpha_{30}(combo) = 0.0267/^\circ C$

P.T.O →

Scanned with CamScanner

Now,

$$\beta_2 = \frac{\beta'_1}{1 + \beta_1 \times \Delta t}$$

$$= \frac{0.0266}{1 + 0.0266 \times 30}$$

$$= 0.014 \ /^\circ C$$

at $60^\circ C$