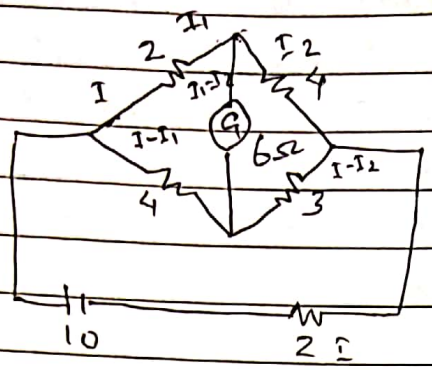
Ashwani kr. Chaudhary
[ECT-A] 019.

Test - 1

Q.2) c.



Soln,

Now, In loop 1st

$\Rightarrow -4(I-I_1)+6(I_1-I_2)+2I_1=0$

$\Rightarrow -4I+4I_1+6I_1-6I_2+2I_1=0$

$\therefore 12I_1-6I_2-4I=0 \quad -(i)$

In loop 2nd.

$\Rightarrow -3(I-I_2)+4I_2-6(I_1-I_2)=6$

$\Rightarrow -3I+3I_2+4I_2-6I_1+6I_2=0$

$\therefore -6I_1+13I_2-3I=0 \quad -(2)$

In 3rd loop

$\Rightarrow -10+2I+3(I-I_2)+4(I-I_1)=0$

$\Rightarrow 2I+3I-3I_2+4I-4I_1=10$

$\therefore -4I_1-3I_2+9I=10 \quad -(3)$

now

writing above eqn in matrix for.

$$\begin{bmatrix} 12 & -6 & -4 \\ -6 & 13 & -3 \\ -4 & -3 & 9 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I \end{bmatrix} = \begin{bmatrix} 6 \\ 0 \\ 10 \end{bmatrix}$$

now,

$$\begin{bmatrix} I_1 \\ I_2 \\ I \end{bmatrix} = \begin{bmatrix} 35/31 \\ 30/31 \\ 60/31 \end{bmatrix}$$

so,

$I_1 = 1.12\ A$

$I_2 = 0.96\ A$

$I = 1.935A$

now,

Current through galvanometer

$I_{req} = (I_1 - I_2)$

$= (1.12 - 0.96)$

$= 0.16A$ Ans

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(1) Soln;

when temp. is 25° we have

$V = 120V$

$I = 15A$

$R_{25} = ?$

now,

$V = IR$

$R_{25} = V/I = \frac{120}{15}$

$= 8\Omega$

At temp 70°C we have

$V = 120V$

$I = 9A$

$R_{70} = ?$

again

$R_{70} = V/I = \frac{120}{9}$

$= 13.33\Omega$

now

$R_{70} = R_{25}(1 + \alpha_{25}\Delta t)$

$13.33 = 8(1 + \alpha_{25} \times 45)$

$1.66 = 1 + 45\alpha_{25}$

$45\alpha_{25} = 0.66$

$\alpha_{25} = 0.0167 /°C$

now $R_{80} = ?$

$R_{80} = R_{25}(1 + \alpha_{25}\Delta t)$

$= 8(1 + 0.0146 \times 55)$

$= 14.424\Omega$

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Now,

$V = IR$

$R = \frac{120}{14.424}$

$= 8.31\ \Omega$ at $30°C$

We know,

$$\alpha_{20} = \frac{\alpha_1}{1+\alpha_1(t_2-t_1)}$$

$$\alpha_{20} = \frac{\alpha_{25}}{1+\alpha_{25}(20-25)}$$

$$= \frac{0.0146}{1+0.014\times(-5)}$$

$$= 0.0157\ /°C.$$

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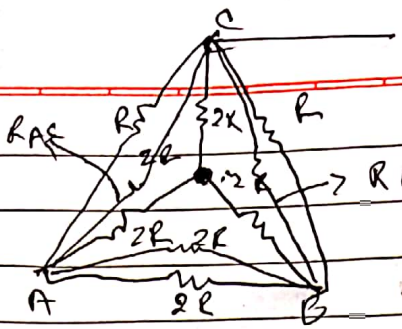
Q.(3)



The star connected N/w at junction A, B, & C can be converted into Δ connection.

$$R_{AB} = 2R + 2R + \frac{2R \cdot 2R}{2R}$$

$$= 6\,R$$

$$R_{AC} = 2R + 2R + \frac{2R \cdot 2R}{2R}$$

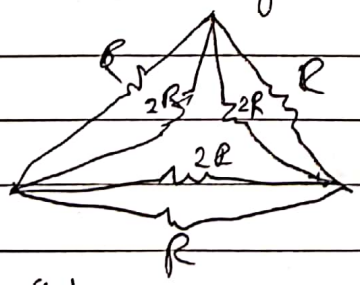
$$= 6\,R$$

$$R_{BC} = 2R + 2R + \frac{2R \cdot 2R}{2R}$$

$$= 6R$$

Now

Transformed figure



total resistance

$$R_{AB} = \left[(6R \| 2R)\right] \| \left[R \| 6R\right] + \left[6R \| R\right]$$

$$R_{AB} = \left(\frac{6R}{4}\right) \| \left(\frac{6R}{7}\right) + \left[\frac{6R}{7}\right]$$

$$R_{AB} = \frac{6R}{11} + \frac{6R}{7}$$

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$$R_{AB} = R\left[\frac{6}{11} + \frac{6}{7}\right]$$

$$= \frac{108}{77} R \ \Omega$$

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