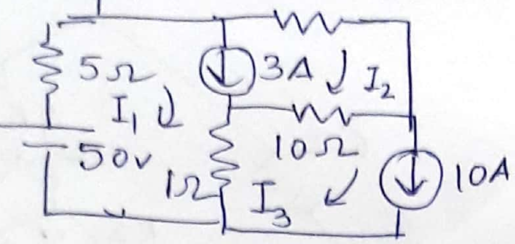
Q2 a) Supermesh



mesh ① & ② forms

$I_1 - I_2 = 3A \longrightarrow \boxed{2M}$

$50 - 5I_1 - 5I_2 - 10(I_2 - I_3) - 1(I_1 - I_3) = 0.$

$-6I_1 - 15I_2 + 11I_3 = -50 \longrightarrow \boxed{2M}$

$\boxed{I_3 = 10.} \longrightarrow \boxed{1M}$

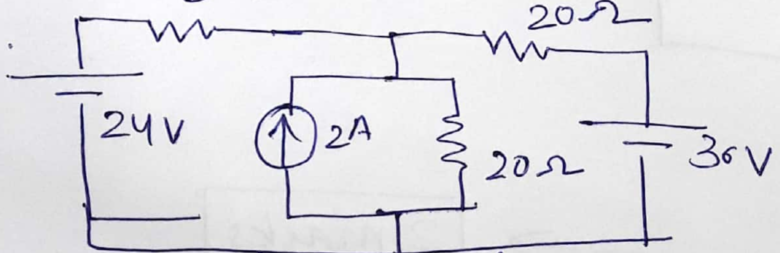
On solving the equations we get

$I_1 = 9.76A$
$I_2 = 6.76A.$
$I_3 = 10A$ $\longrightarrow \boxed{2M}$

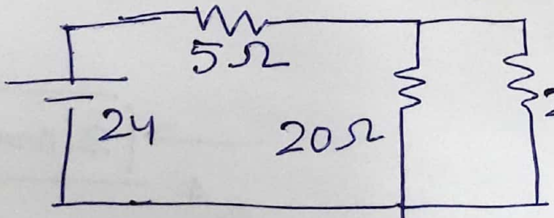
Power delivered by voltage source $= 50I_1$ (01m)
$= 50 \times 9.76 = 488W.$

$I_{10\Omega} = I_3 - I_2 = \boxed{3.24A}$ (02m)

Q 2(b).



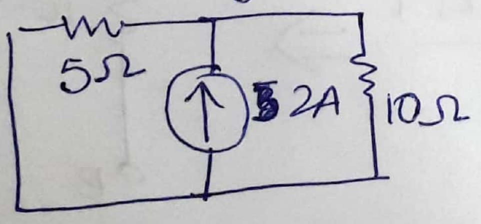
using Superposition theorem.
① considering 24V only



$I'_{5\Omega} = \dfrac{24}{5+10} = 1.6A$ $(\rightarrow)$

$\longrightarrow$ (3M)

② considering 2A acting alone.

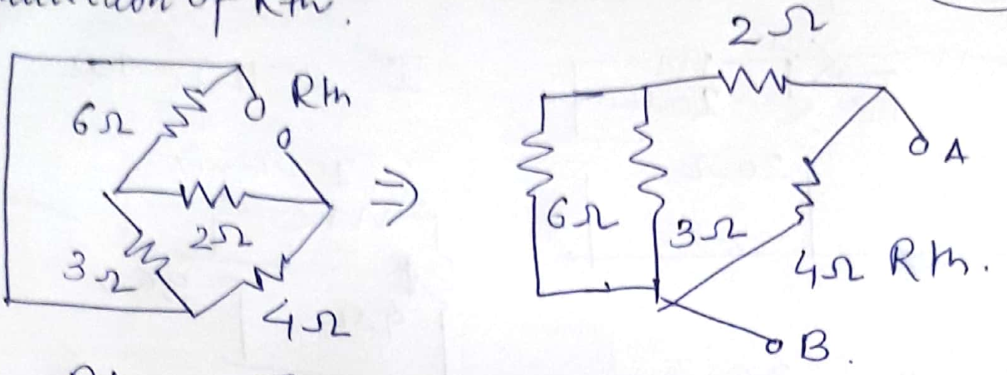


$I''_{5\Omega} = \dfrac{2 \times 10}{5+10} = 1.33A$ $(\leftarrow)$

(3M)

Scanned by CamScanner

(ii) Calculation of R_{th}.



$R_{th} = [(6 \| 3) + 2] \| 4 = 2\Omega$

$R_L = R_{th} = 2\Omega \longrightarrow \boxed{4M}$

(iii) Calculation of $P_{max} = \dfrac{V_{th}^2}{4R_{th}} = \boxed{450W}$ (2M)

Q3(b). Solution $v = V_m \sin\theta \quad 0 < \theta < \pi/4$

$= 0.707 V_m \quad \pi/4 < \theta < 3\pi/4$ (01)

$= V_m \sin\theta \quad 3\pi/4 < \theta < \pi$

(i) Average value

$$V_{avg} = \frac{1}{\pi}\int_0^{\pi} v(\theta)\, d\theta$$

$$= \frac{1}{\pi}\left[\int_0^{\pi/4} V_m \sin\theta\, d\theta + \int_{\pi/4}^{3\pi/4} 0.707 V_m\, d\theta + \int_{3\pi/4}^{\pi} V_m \sin\theta\, d\theta\right]$$

$$= \frac{V_m}{\pi}\left\{\left[-\cos\theta\right]_0^{\pi/4} + 0.707\left[\theta\right]_{\pi/4}^{3\pi/4} + \left[-\cos\theta\right]_{3\pi/4}^{\pi}\right\}$$ (03)

$$= \frac{V_m}{\pi}(0.293 + 1.11 + 0.293) = \boxed{0.54 V_m}$$

(ii) rms value of waveform.

$$V_{rms} = \sqrt{\frac{1}{\pi}\int_0^{\pi} v^2(\theta)\, d\theta}$$

$$= \sqrt{\frac{1}{\pi}\left[\int_0^{\pi/4} V_m^2 \sin^2\theta\, d\theta + \int_{\pi/4}^{3\pi/4} (0.707 V_m)^2\, d\theta + \int_{3\pi/4}^{\pi} V_m^2 \sin^2\theta\, d\theta\right]}$$ (03)

$$= \sqrt{\frac{V_m^2}{\pi}\left[\theta/2 - \frac{\sin 2\theta}{2}\right]_0^{\pi/4} + 0.499\left[\theta\right]_{\pi/4}^{3\pi/4} + \left[\frac{\theta}{2} - \frac{\sin 2\theta}{4}\right]_{3\pi/4}^{\pi}}$$

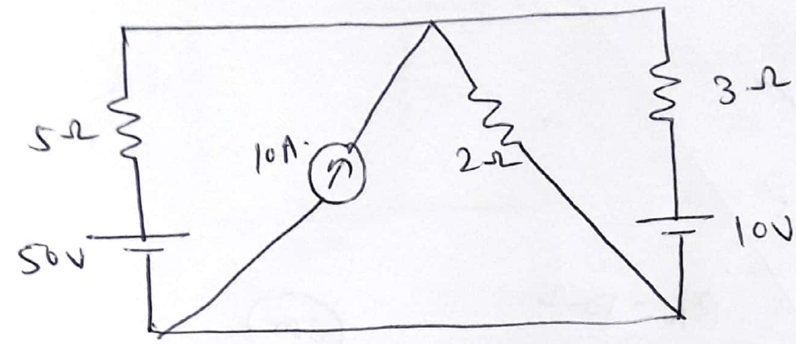
$= \sqrt{0.341\, V_m^2} = \boxed{0.584\, V_m}$

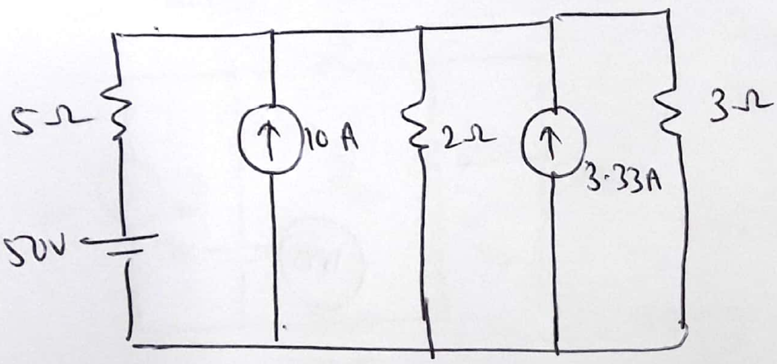
iii form factor $= \dfrac{\text{Rms value}}{\text{Average value}} = \dfrac{0.584 V_m}{0.54 V_m} = 1.081$

iv) Peak factor $= \dfrac{\text{maximum value}}{\text{Rms value}} = \dfrac{1 V_m}{0.584 V_m} = 1.71$

3m

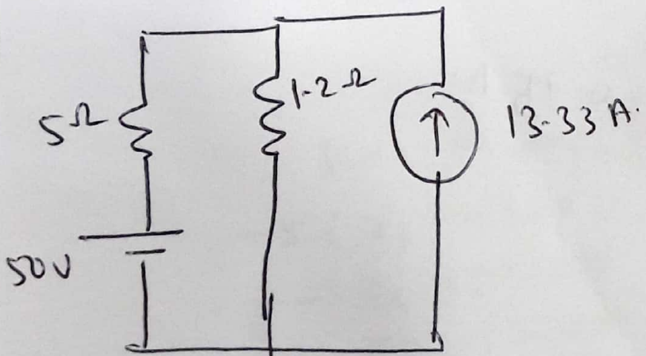
Q.4 (a) $I_{5\Omega} = ?$



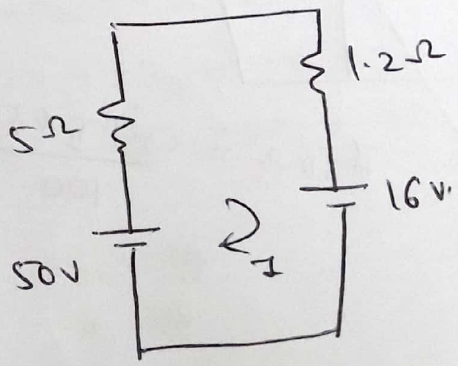


2m

1m



1m



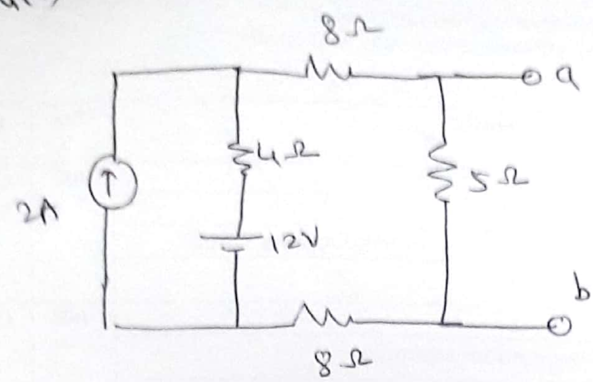
$50 - 5I - 1.2I - 16 = 0$

$I = 5.48\text{ A } (\uparrow)$

1m

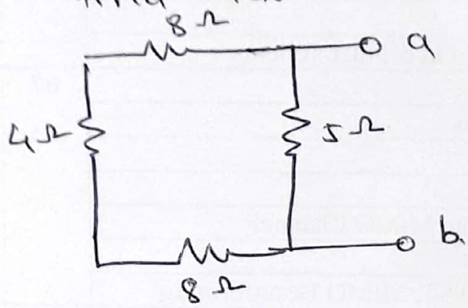
Nortons.

Q.4(b)



$R_L = 50\Omega$

To find R_N.

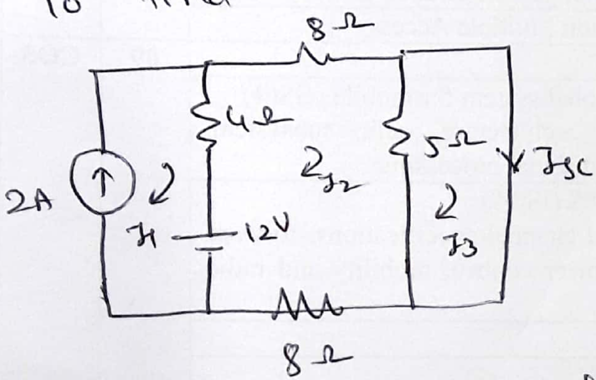


$R_N = (8+4+8) \parallel 5$

$= 20 \parallel 5$

$R_N = 4\Omega$ (01 m)

To find I_N.



$I_3 = I_{sc}$.

$I_1 = 2A$.

KVL to loop II

$12 - 4(I_2 - I_1) - 8I_2 - 5(I_2 - I_3) - 8I_2 = 0$

$12 - 4I_2 + 4I_1 - 8I_2 - 5I_2 + 5I_3 - 8I_2 = 0$ — (1)

$4I_1 - 7I_2 + 5I_3 = -12$

$-25 I_2 + 5I_3 = -20$ (2m)

KVL to loop (III)

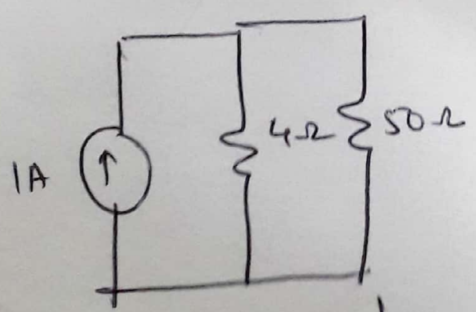
$-5(I_3 - I_2) = 0$

$-5I_3 + 5I_2 = 0$

$5I_2 - 5I_3 = 0$

$I_2 = 1A$

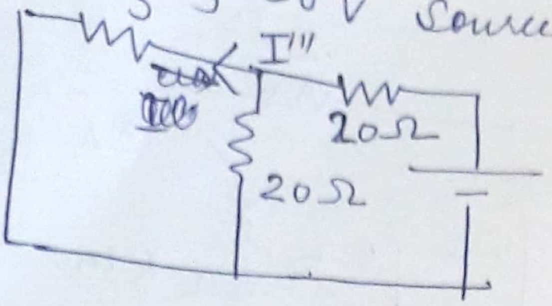
$I_3 = 1A$.



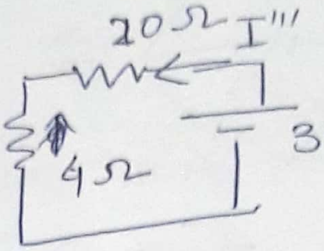
(1m)

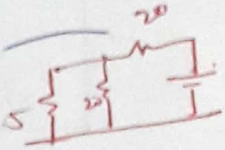
$I_{50\Omega} = \frac{1 \times 4}{54} = 0.0740$ Amp. (1m)

...ing 36 V Source alone.



$20 \| 5 = 4\Omega$





$$I''' = \frac{36}{4+20} = \frac{36}{24}$$
$= (1.5A) \leftarrow$

$I_{5\Omega} = \frac{1.5 \times 20}{25}$
$= 1.2A (\leftarrow)$ → (3M)

By superposition therem.

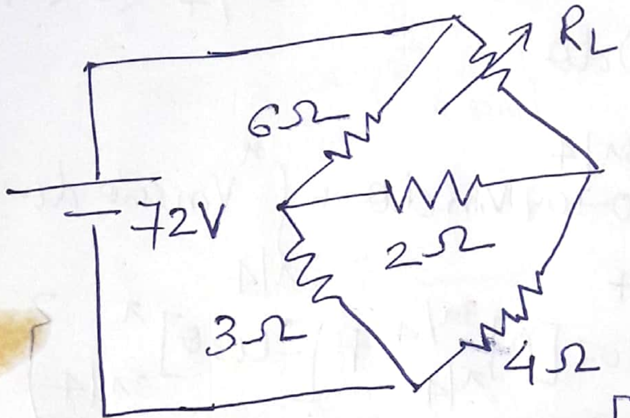
$$I_{5\Omega} = \overset{24V}{I'_{5\Omega}} + \overset{2A}{I''_{5\Omega}} + \overset{36V}{I''_{5\Omega}}$$

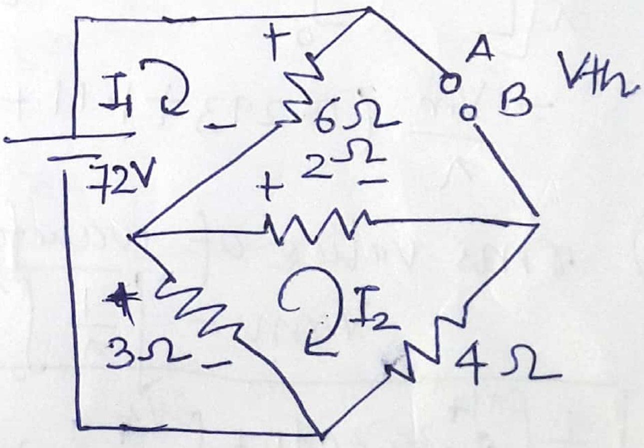
$1.2 (\leftarrow)$.

$= 1.6 (\rightarrow) + 1.33 (\leftarrow) + 1.5 \leftarrow)$ $= 0.933A (\leftarrow)$.

$\boxed{= 1.23 A (\leftarrow)}$ → (1M)

Q3 a)





(1) Calculation of Vth

KVL at mesh 1

$72 - 6I_1 - 3(I_1 - I_2) = 0$

$9I_1 - 3I_2 = 72$

KVL at mesh 2

$-3(I_2 - I_1) - 2I_2 - 4I_2 = 0$.

$-3I_1 + 9I_2 = 0$

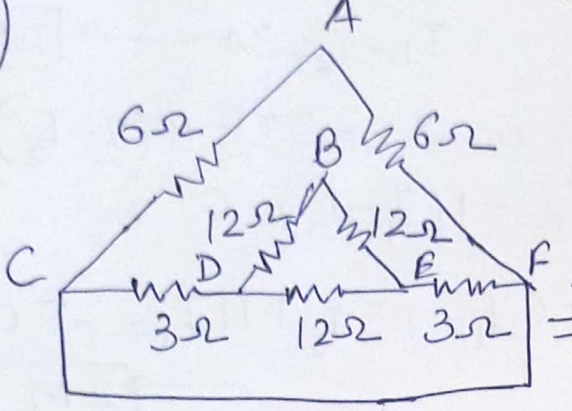
$I_1 = 9A, \; I_2 = 3A$.

$V_{th} - 6I_1 - 2I_2 = 0$

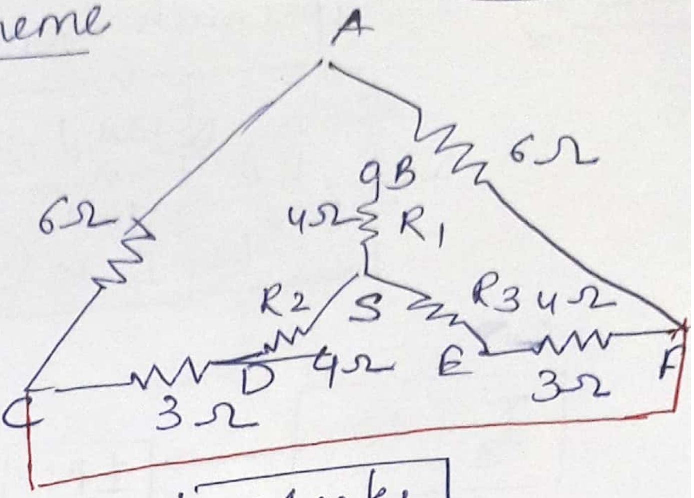
$= 60V$ → (4M)

Solution & Scheme

Q1)

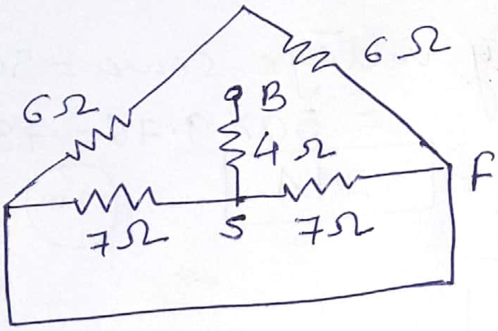


$\Rightarrow$

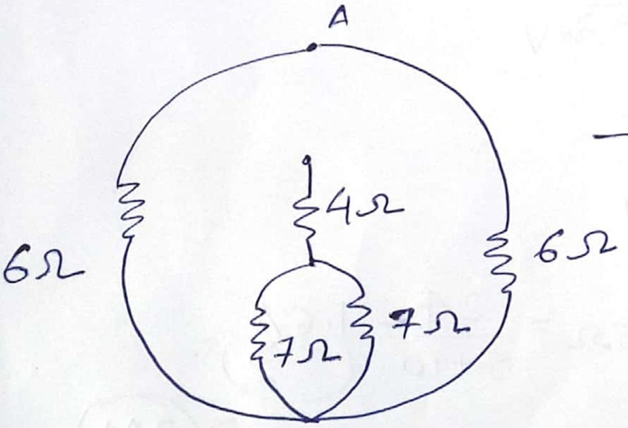


$R_1 = R_2 = R_3 = \frac{12 \times 12}{12+12+12} = 4\Omega \longrightarrow \boxed{2 \text{ Marks}}$

In branch CDS 3Ω & 4Ω in series
also ~~BSE~~ in SEF 4Ω & 3Ω in series



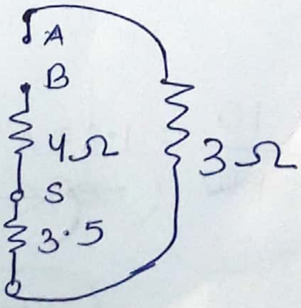
$\longrightarrow \boxed{2 \text{ Marks}}$



$\longrightarrow \boxed{2 \text{ marks}}$

$7 \parallel 7 = 3.5\Omega$

$6 \parallel 6 = 3\Omega$



$\longrightarrow \boxed{2 \text{ marks}} \Rightarrow$

$\longrightarrow \boxed{2 \text{ marks}}$