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Date
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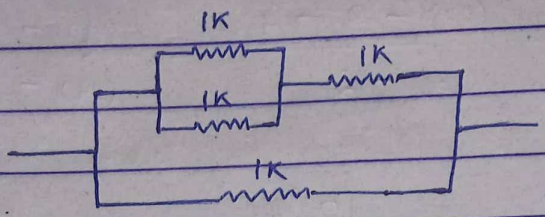
ELECTRICAL SCIENCE - I (15B11EC111)

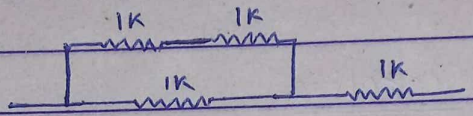
Tutorial Sheet - 1

Q.1. 4 Resistor each 1 K

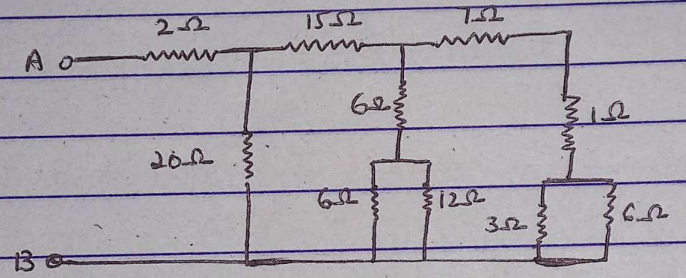
3/5 K →



5/3 K →

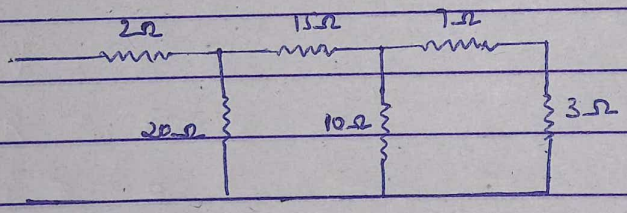


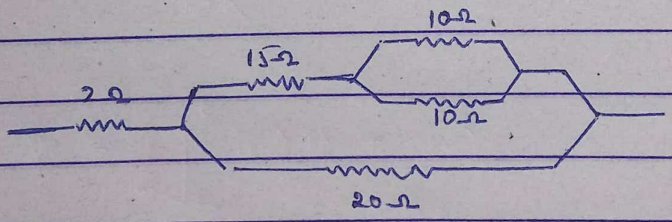
Q.2. (i)



$\frac{1}{R} = \frac{1}{3} + \frac{1}{6}$

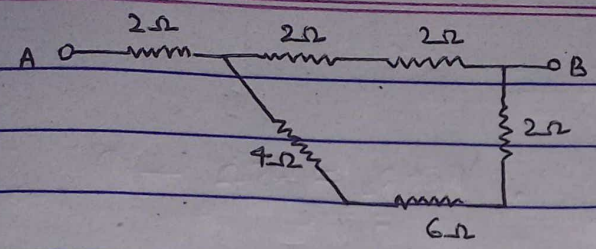
$R = 2\Omega$





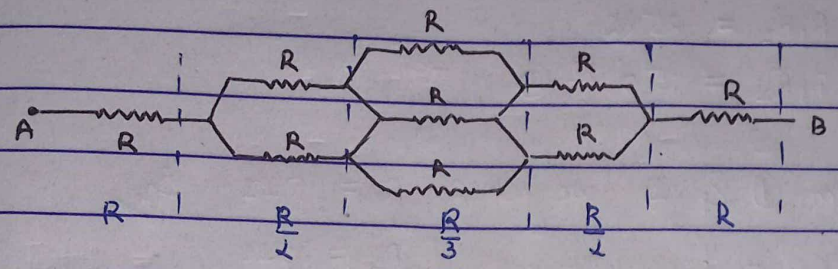
$$R_{net} = 2 + \frac{20 \times 20}{40} = 12\ \Omega$$

(ii)



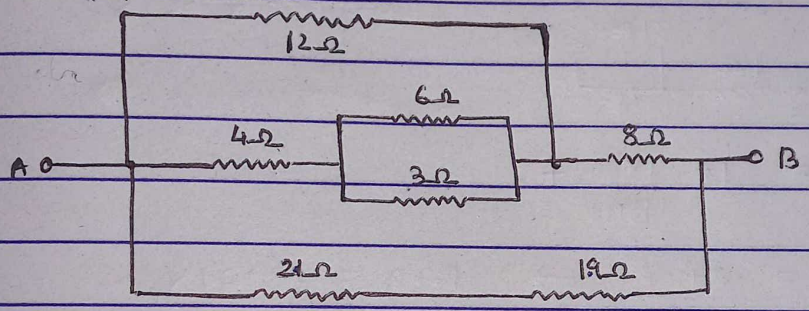
$R_{net} = 2 + \frac{4 \times 12}{16} = 5\,\Omega$

(iii)

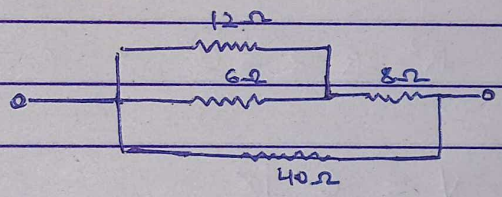


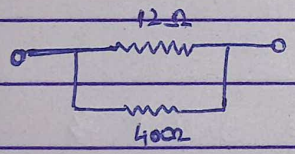
$R_{net} = R + \frac{R}{2} + \frac{R}{3} + \frac{R}{2} + R = \frac{10R}{3}$

(iv)



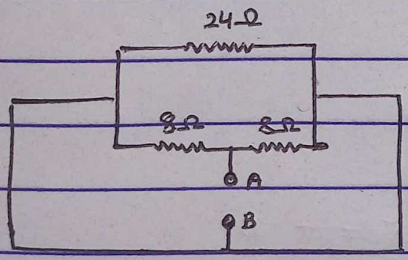
$R_{net} = ?$



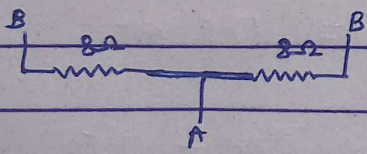


$R_{net} = \frac{12 \times 40}{16} = 3\,\Omega$

(v)



$R_{net} = \frac{16 \times 24}{40}$?



$R_{net} = \frac{8 \times 8}{16} = 4\,\Omega$

Q.3. $R_1, R_2 = ?$

$$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{6}, \quad R_1 + R_2 = 25\Omega \quad -①$$

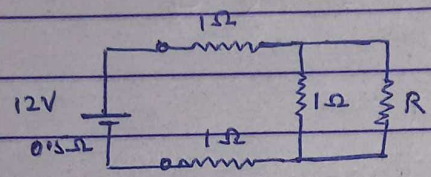
$$R_1 R_2 = 25 \times 6$$

$$R_1 R_2 = 150 \quad -②$$

from ① & ② we get : $R_1 = 15\Omega$ Ans

$R_2 = 10\Omega$

Q.4.



let Net R be R

$$R = 1 + \frac{1 \times R}{R+1} + 1$$

$$R = 2 + \frac{R}{R+1} \rightarrow R^2 + R = 2R + 2 + R$$

$$R^2 - 2R - 2 = 0 \rightarrow R = 1+\sqrt{3}, \; 1-\sqrt{3}\,\Omega$$

$$V = \epsilon - ir$$

$$iR = \epsilon - ir$$

$$i = \frac{\epsilon}{r+R} = \frac{12}{0.5 + 2.73} = 3.71 \text{ A}$$

Q.5. $$v = \frac{1}{C}\int_{t_0}^{t} i(t)\,dt + v(t_0)$$

$0 < t < 2$: $$v = \frac{1}{4 \times 10^{-3}} \int_0^2 15\,dt + 10$$

$$= \frac{30}{4} + 10 = 17.5 \text{ volt}$$

$2 < t < 4$: $$v = \frac{1}{4 \times 10^{-3}} \int_2^t (-10) \times 10^{-3}\,dt + 17.5$$

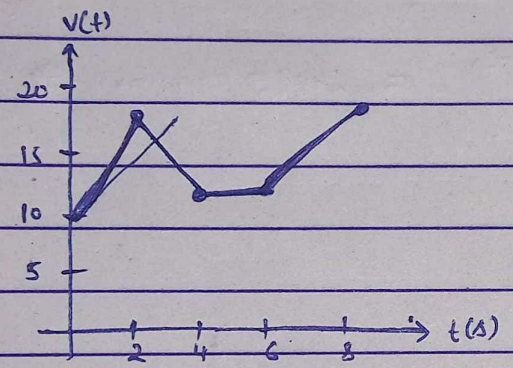
$$= 22.5 + 2.5t$$

$v = -5 + 17.5 = 12.5$ volt

$4 < t < 6$: $v = \frac{1}{4\times10^{-3}} \int_{2}^{t} 0\,dt + 12.5 = 12.5$ volt

$6 < t < 8$: $v = \frac{1}{4\times10^{-3}} \int_{4}^{t} 10\times10^{-3}\,dt + 12.6 = 2.5t - 2.5$

$$v(t) = \begin{cases} 10 + 3.75t, & 0<t<2 \\ 22.5 - 2.5t, & 2<t<4 \\ 12.5, & 4<t<6 \\ 2.5t - 2.5, & 6<t<8 \end{cases}$$



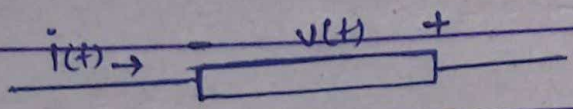
Q.6. $L = 2H$

$$i(t) = \begin{cases} 0, & t \le 0 \\ 4t, & 0 < t \le 2 \\ -4t + 16, & 2 < t \le 4 \end{cases}$$

$$w = \frac{1}{2}Li^2 = \begin{cases} 0, & t \le 0 \\ 16t^2, & 0 \le t \le 2 \\ 16t^2 - 128t + 256, & 2 \le t \le 4 \end{cases}$$

$$p(t) = \frac{dw}{dt} = \begin{cases} 0, & t \le 0 \\ 32t, & 0 < t \le 2 \\ 32t - 128, & 2 < t \le 4 \end{cases}$$

Q.7.



$v(t) = 12e^{-8t}$ Volt , $i(t) = 5e^{-8t}$ Amp. $t \geq 0$

$$P(t) = v(t)\, i(t) = 12e^{-8t} \times 5e^{-8t}$$

$$= 60e^{-16t} \text{ watt}$$

$$w(t) = \int_0^{0.1} P(t)\, dt = \int_0^{0.1} 60e^{-16t}\, dt$$

$$= \frac{60 \times e^{-16t}}{-16} + \frac{60}{16} = \frac{60}{16}\left(1 - e^{-1.6}\right)$$

$$w(0.1) = \frac{60}{16}\left(1 - e^{-1.6}\right) = 2.99 \text{ J (approx)}$$