Example 2.79 *Obtain the star connected equivalent for the delta connected circuit shown in Fig. 2.130.*

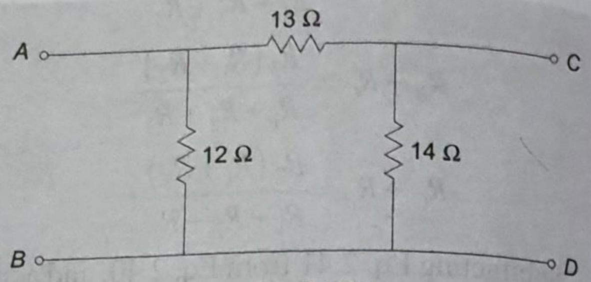


Fig. 2.130

Solution The above circuit can be replaced by a star connected circuit as shown in Fig. 2.131(a).

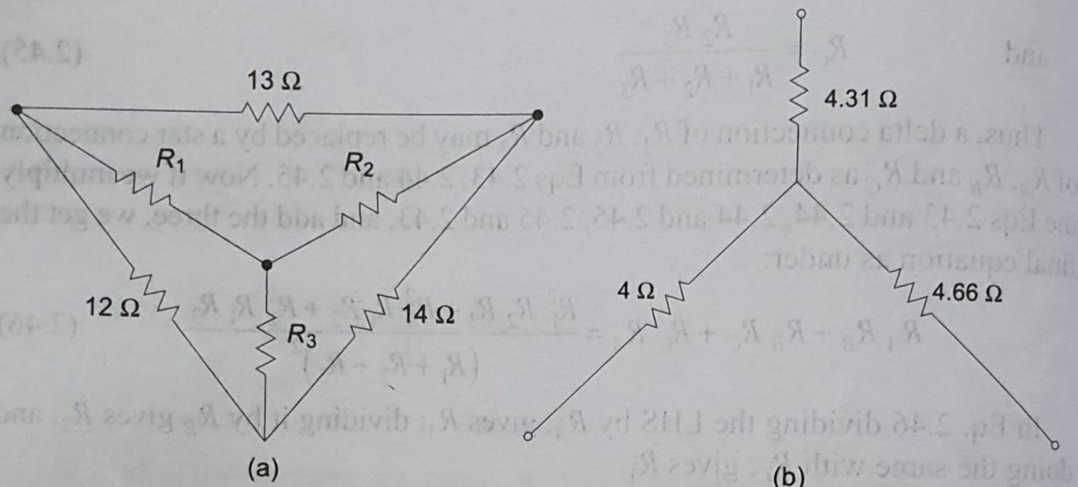


Fig. 2.131

Performing the Δ to *Y* transformation, we obtain

$$R_1 = \frac{13\times12}{14+13+12}, \quad R_2 = \frac{13\times14}{14+13+12}$$

and $$R_3 = \frac{14\times12}{14+13+12}$$

$$\therefore \qquad R_1 = 4\ \Omega,\ R_2 = 4.66\ \Omega,\ R_3 = 4.31\ \Omega$$

The star-connected equivalent is shown in Fig. 2.131 (b).

Example 2.80 *Obtain the delta-connected equivalent for the star-connected circuit shown in Fig. 2.132.*

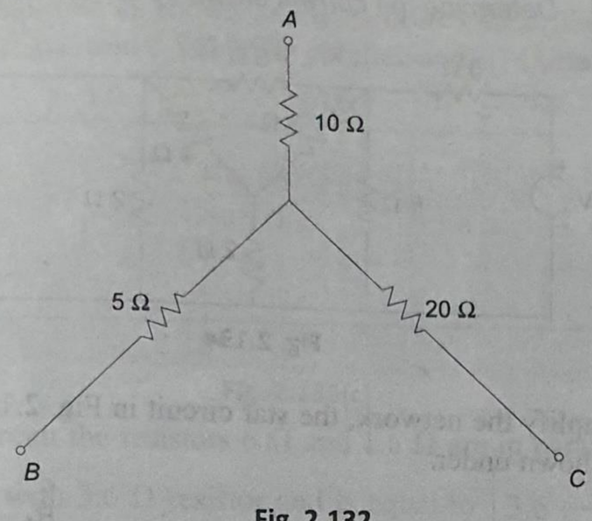


Fig. 2.132

Solution The above circuit can be replaced by a delta-connected circuit as shown in Fig. 2.133(a).

Performing the Y to Δ transformation, we get from the Fig. 2.133 (a)

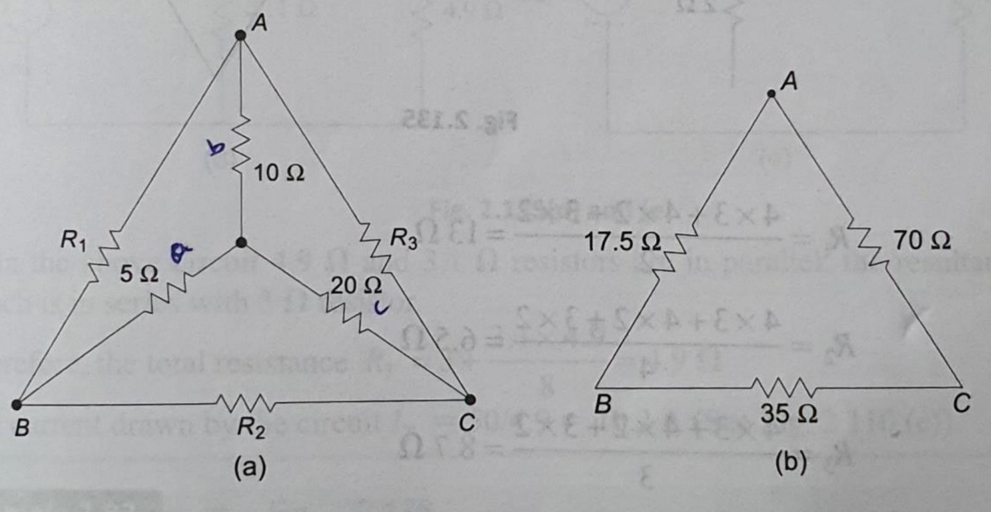


Fig. 2.133

$$R_1 = \frac{20\times10+20\times5+10\times5}{20} = 17.5\,\Omega$$

$$R_2 = \frac{20\times10+20\times5+10\times5}{10} = 35\,\Omega$$

and

$$R_3 = \frac{20\times10+20\times5+10\times5}{5} = 70\,\Omega$$

The equivalent delta circuit is shown in Fig. 2.133 (b).

Example 2.81 *Determine the current drawn by the circuit shown in Fig. 2.134.*

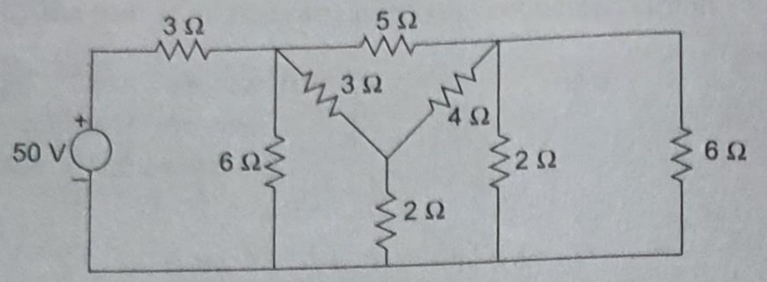


Fig. 2.134

Solution To simplify the network, the star circuit in Fig. 2.134 is converted into a delta circuit as shown under.

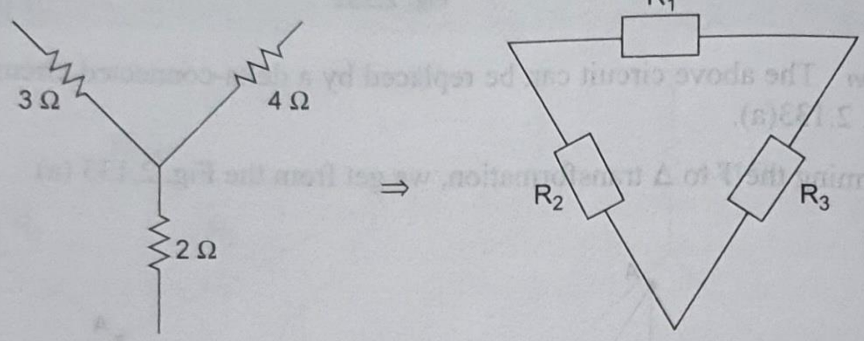


Fig. 2.135

$$R_1 = \frac{4\times3+4\times2+3\times2}{2} = 13\ \Omega$$

$$R_2 = \frac{4\times3+4\times2+3\times2}{4} = 6.5\ \Omega$$

$$R_3 = \frac{4\times3+4\times2+3\times2}{3} = 8.7\ \Omega$$

The original circuit is redrawn as shown in Fig. 2.135(b).

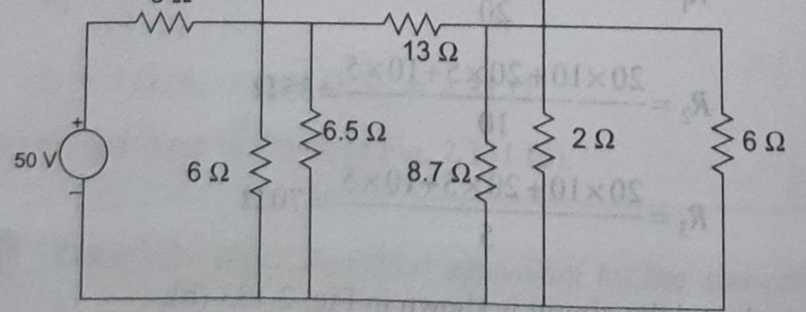


Fig. 2.135(b)

It is further simplified as shown in Fig. 2.110(c). Here the resistors 5 Ω and 13 Ω are in parallel, 6 Ω and 6.5 Ω are in parallel, and 8.7 Ω and 2 Ω are in parallel.

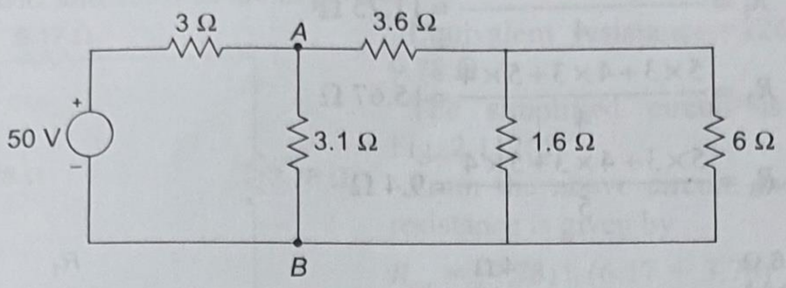
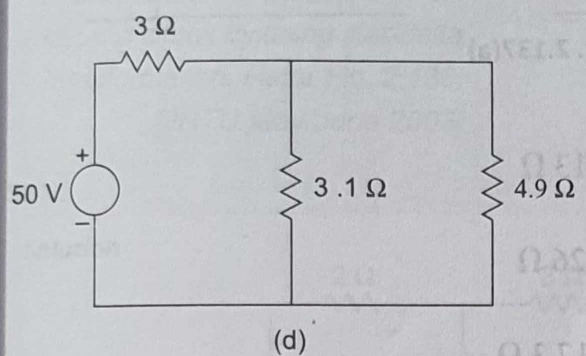


Fig. 2.135(c)

In the above circuit the resistors 6 Ω and 1.6 Ω are in parallel, the resultant of which is in series with 3.6 Ω resistor and is equal to $\left[3.6+\frac{6\times1.6}{7.6}\right]=4.9\ \Omega$ as shown in Fig. 2.110(d).



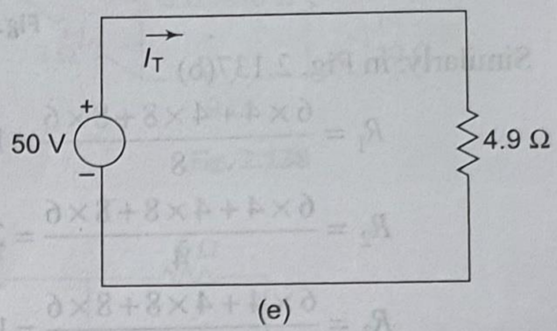


Fig. 2.135(d) and (e)

In the above circuit 4.9 Ω and 3.1 Ω resistors are in parallel, the resultant of which is in series with 3 Ω resistor.

Therefore, the total resistance $R_T = 3+\frac{3.1\times4.9}{8} = 4.9\ \Omega$

The current drawn by the circuit I_T = 50/4.9 = 10.2 A (See Fig. 2.110 (e)).

Example 2.83 *Find the voltage to be applied across AB in order to drive a current of 5A into the circuit by using star-delta transformation. Refer Fig. 2.138.*

[JNTU May/June 2006]

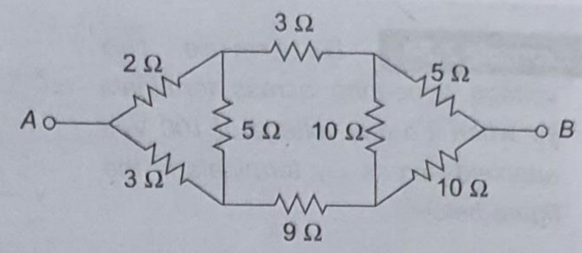


Fig. 2.138

Solution

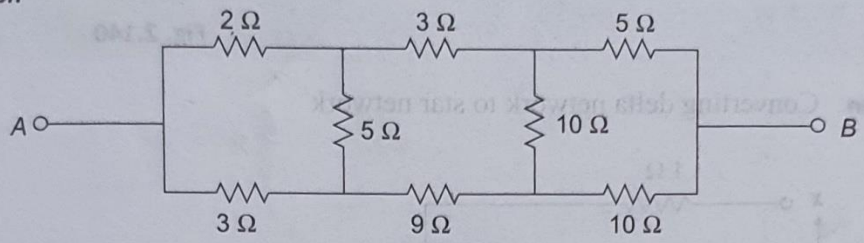


Fig. 2.139

Using star-delta transformation

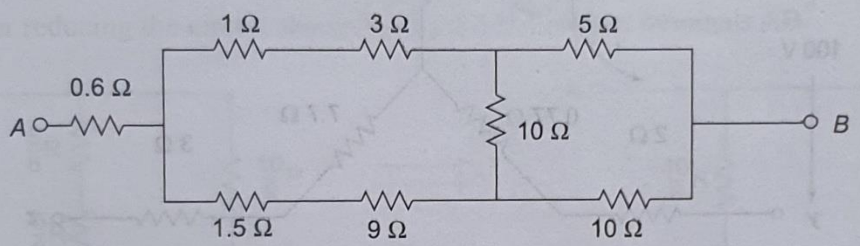


Fig. 2.139(a)

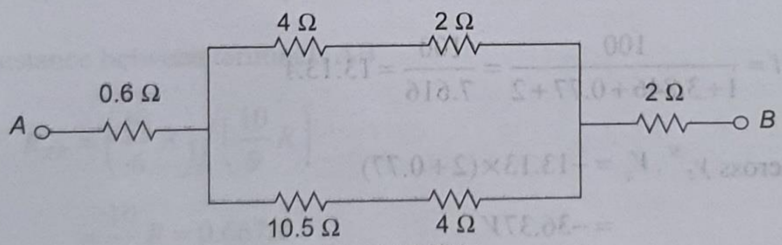


Fig. 2.139(b)

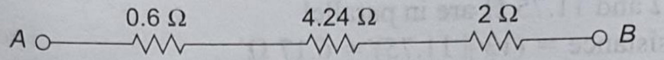
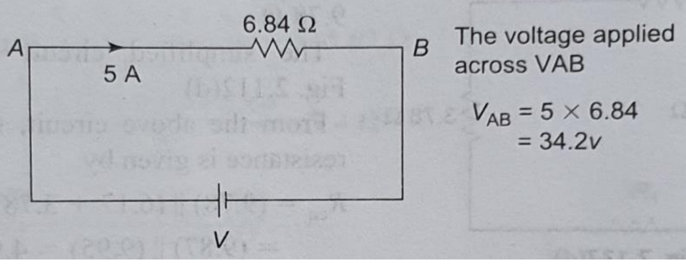


Fig. 2.139(c)



The voltage applied across VAB

$V_{AB} = 5 \times 6.84$

$= 34.2v$