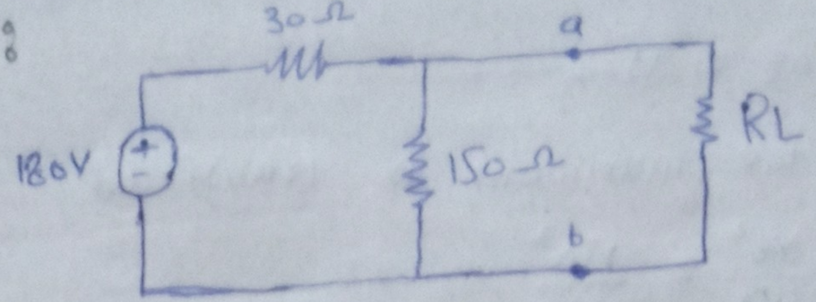
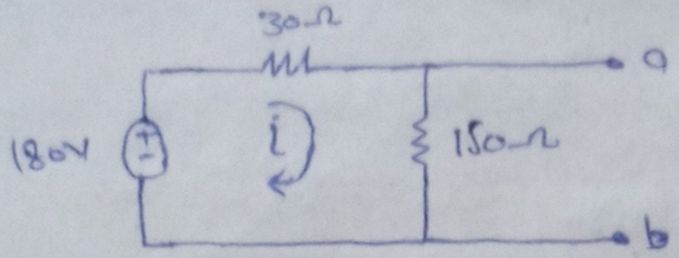
(4)

Ans :- Sol:



let us determine thevenine equivalent ckt as seen from a-b



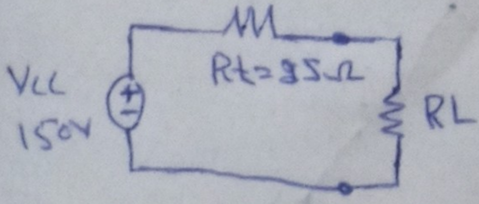
$$I = \frac{180}{30+150} \Rightarrow \frac{180}{180} \Rightarrow \boxed{1A}$$

$V_{an} = V_{oh} = 150 \times 1 \Rightarrow \boxed{150V}$

To find Rt, deactivat 180V source,

$$R_t = \frac{30 \times 150}{30+150} \Rightarrow \boxed{25\,\Omega}$$

The thevenine equivalent



The maximum is transfered when

$R_L = R_t = 25\Omega$

Then the maximum is transfered

$$P_{max} = \frac{V_t^2}{4R_t} = \frac{150^2}{4\times 25}$$

$P_{max} = 2.25$ watts.

The thevenin source V_t provide total power of

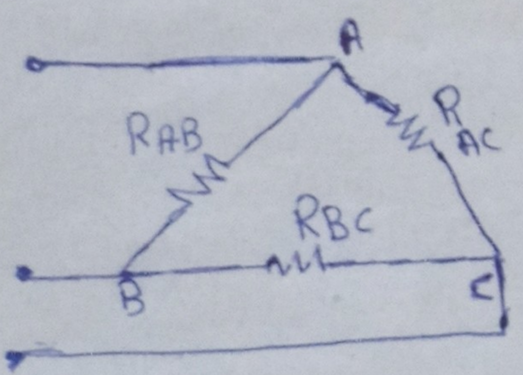
$$P_t = 150\times i = 150\left(\frac{150}{25+25}\right)$$

$\boxed{P_t = 450 \text{ watts}}$ => Ans.

Q1

Ans:

Part (A): Star to Delta Transformation.



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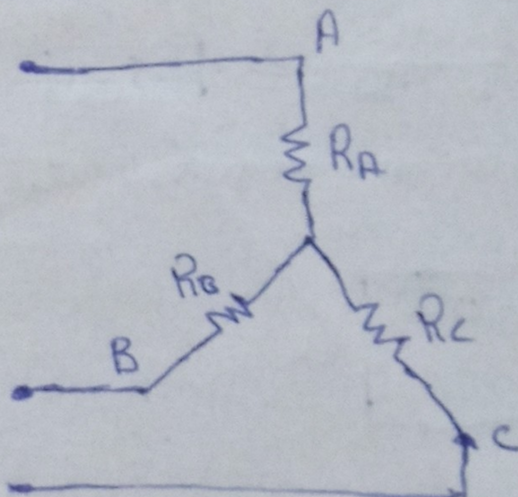


Fig = A

Fig B.

Let R_{AB}, R_{BC} and R_{AC} be the three resistance as connected to delta as shown in fig (a) R_A, R_B and are the three equivalent resistance as connected in star as shown in fig (b)

The equivalent resistance between A and B

$$\therefore R_A + R_B = \frac{R_{AB}(R_{BC}+R_{CA})}{R_{AB}+R_{BC}+R_{CA}} \quad \text{—— (1)}$$

Between B and C

$$R_B + R_C = \frac{R_{BC}(R_{CA}+R_{AB})}{R_{AB}+R_{BC}+R_{AC}} \quad \text{—— (2)}$$

Between C and A

$$R_C + R_A = \frac{R_{AC}(R_{AB}+R_{BC})}{R_{AB}+R_{BC}+R_{AC}} \quad \text{—— (3)}$$

eq (1) & (2)

$$\cancel{2}R_A = \frac{\cancel{2}R_{AB}R_{AC}}{R_{AB}+R_{BC}+R_{CA}}$$

$$\boxed{R_A = \frac{R_{AB}R_{AC}}{R_{AB}+R_{BC}+R_{AC}}} \quad \text{—— (4)}$$

In similar way $\boxed{R_B = \frac{R_{AB} R_{BC}}{R_{AB}+R_{BC}+R_{AC}}}$ ⇒ ⑦

and $\boxed{R_C = \frac{R_{BC} R_{AC}}{R_{AB}+R_{BC}+R_{AC}}}$ ⇒ ⑧

② Star to delta Transformation :-

From eq ⑥, ⑦ and ⑧ we write

$$R_A R_B + R_B R_C + R_C R_A = \frac{R_{AB} R_{BC} R_{CA}(R_{AB}+R_{BC}+R_{CA})}{(R_{AB}+R_{BC}+R_{CA})^2}$$

Sub eq ⑤

$$= \frac{R_{BC}}{\Sigma R_{AB}} \times R_A \Sigma R_{AB}$$

$$= R_A R_{BC}$$

$$\therefore R_{BC} = \frac{R_A R_B + R_B R_C + R_C R_A}{R_A} \quad — ⑩$$

In similar way.

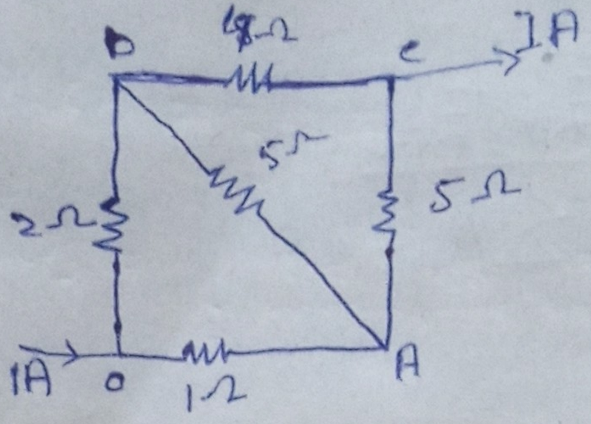
$$R_{AB} = R_A + R_B + \frac{R_A R_B}{R_C} \quad — ⑪$$

In A circuit:

$$Z_A = \frac{Z_{AB} Z_{CA}}{\sum Z_{AB}}, \quad Z_B = \frac{Z_{BC} Z_{AB}}{\sum Z_{AB}}$$

$$Z_C = \frac{Z_{CA} Z_{CB}}{\sum Z_{AB}}$$

Ans ③:



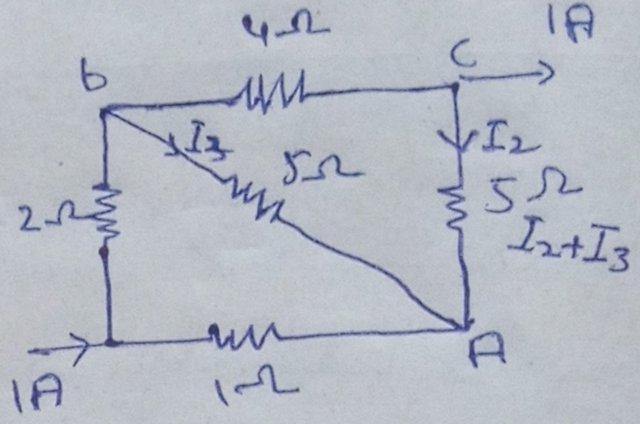
⇒ Junction Rules

© $I = I_1 + I_2$

$I_1 = I_3 + I_4$

$I_2 + I_3 = I_5$

$I_4 + I_5 = I$



Now

1) $I_3 - I(1) - (I_1 - I_3)(i) = \phi$

2) $I_3 - I(3)(1) - (I_2 + I_3)(2) = \phi$

3) $-I_1(1) = I_3(1) + I_2(1) = \phi$

3') $I_2 = I_1 + I_3$

$I_3 = 2I_1 - I_3$

$I_3 = 3(I_1 + I_3) + 2I_3$

$I_3 = 3I_1 + 5I_3$

Ans ②

⇒ Laplace transform of Impulse function.

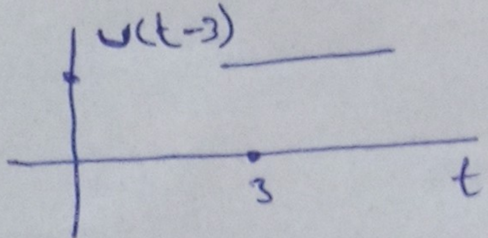
$$I(s) = \int_0^\infty r(t) e^{-st} dt$$

$$= \int_0^\infty 1 \cdot e^{-st} dt = -\frac{1}{s}\left[e^{-st}\right]_0^\infty$$

$$= -\frac{1}{s}[0-1]$$

$$= \frac{1}{s}$$

⇒ laplace transfor of unit function.



$u(t) = 1$ if $t \geq 0$

$u(t-3) = 1$ if $t-3 \geq 0$

$\rightarrow t \geq 3$

$u(t) = 0$ if $t < 0$

$u(t-3 = 0$ if $t-3 < 0$

$\rightarrow t < 3$

⇒ Laplace transform of Ramp function

$r(t) = t\,u(t)$

$$R(s) = \int_0^\infty \underbrace{t e^{-st}\, dt}_{dv} \underbrace{=}_{\text{parts}} \frac{t e^{-st}}{-s}\Big|_0^\infty - \int_0^\infty \frac{e^{-st}}{-s}\, dt$$

$$\underbrace{=}_{Re[s]>0} \frac{1}{s} \int_0^\infty e^{-st}\, dt = \frac{1}{s} \cdot \left(\frac{e^{-st}}{-s}\Big|_0^\infty \right)$$

$$\underbrace{=}_{Re[s]>0} \frac{1}{s} \cdot \left(0 - \frac{1}{-s}\right) = \frac{1}{s^2}$$