**B.Sc. Part-2 Physics (Hons) Paper-iv, Lecture-18 on the topic**

**“Star to Delta network and Delta to Star network Transformation.”**

Dr. Mohammad Aslam, Dept. of Physics

B.Sc. Part-2, physics (Hons), Paper-IV

Lecture-18.

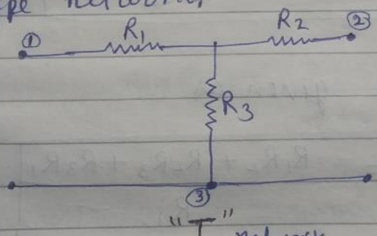


* Star to Delta and Delta to star transformation

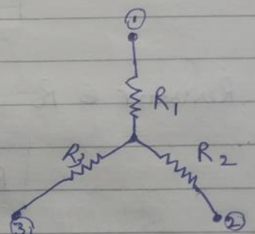
If a three phase, 3-wire supply or even a three phase load is connected in one type of configuration, it can be easily transformed or changed it into an equivalent configuration of the other type by using either the star delta transformation or Delta star transformation process.

A resistive network consisting of three resistors can be connected together to form a 'T' configuration, but the network can also be redrawn to form a star or Y type network.

Ex

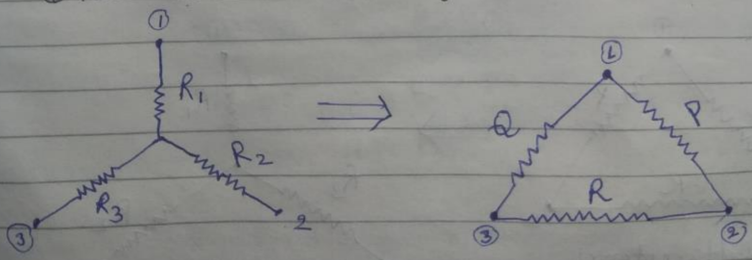



"T"- network




(* star network)

* Star to Delta Transformation :->



The value of the resistor on any one side of the delta, $\Delta$ network is the sum of all the two product combination of resistors in the star network divided by the star resistor located directly opposite the delta resistor being found.

Now resistor P is given as

$$\boxed{P = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3}}$$

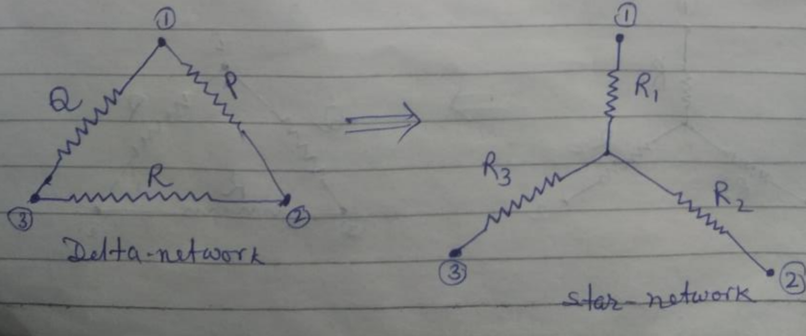
Resistor Q is given as

$$\boxed{Q = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2}}$$

Resistor R is given as

$$\boxed{R = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1}}$$

Delta to Star Transformation :->



To convert a delta network to an equivalent star network we need to drive a transformation formula for equating the various resistors to each other between the various terminals.
Now the resistances between terminal 1 and 2.

$$R_1 + R_2 = \text{Equivalent resistence of parallel combination of } P \text{ and } (Q+R)$$

$$R_1 + R_2 = A$$

where $$\frac{1}{A} = \frac{1}{P} + \frac{1}{Q+R}$$

$$\frac{1}{A} = \frac{Q+R+P}{P(Q+R)}$$

$$A = \frac{P(Q+R)}{P+Q+R}$$

So, $$R_1 + R_2 = \frac{P(Q+R)}{P+Q+R} \quad \text{---} (1)$$

Resistance between the terminal 2 and 3

$$R_2 + R_3 = \text{Equivalent resistance of parallel combination of } R \text{ and } (P+Q)$$

$$R_2 + R_3 = \frac{R(P+Q)}{P+Q+R} \quad \text{---} (2)$$

Resistance between the terminal 1 and 2

$$R_3 + R_1 = \text{Equivalent resistance of parallel combination of } Q \text{ and } (P+R)$$

$$R_3+R_1 = \frac{Q(P+R)}{P+Q+R} \quad \text{---} (3)$$

Now Substracting equation (2) from equation (3)

$$R_3+R_1-(R_2+R_3) = \frac{Q(P+R)}{P+Q+R} - \frac{R(P+Q)}{P+Q+R}$$

$$\cancel{R_3}+R_1-R_2-\cancel{R_3} = \frac{QP+\cancel{QR}-RP-\cancel{RQ}}{P+Q+R}$$

$$R_1-R_2 = \frac{QP-RP}{P+Q+R} \quad \text{---} (4)$$

Now adding equation (4) and (1)

$$R_1-R_2+(R_1+R_2) = \frac{QP-RP}{P+Q+R} + \frac{P(Q+R)}{P+Q+R}$$

$$R_1-\cancel{R_2}+R_1+\cancel{R_2} = \frac{QP-\cancel{RP}+PQ+\cancel{PR}}{P+Q+R}$$

$$\cancel{2}R_1 = \frac{\cancel{2}PQ}{P+Q+R} \qquad (\because PQ=QP)$$

$$\boxed{R_1 = \frac{PQ}{P+Q+R}}$$

Similarly,
Now Substracting equation (3) from equation (1) and adding with equation (2) we get

$$R_2 = \frac{PR}{P+Q+R}$$

Now, Substracting equation (1) from equation (2) and adding with equation (3) we get

$$\boxed{R_3 = \frac{QR}{P+Q+R}}$$