# SNS COLLEGE OF TECHNOLOGY

**(An Autonomous Institution)**
**COIMBATORE-35**
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# 23EET102 / ELECTRIC CIRCUIT ANALYSIS
# I YEAR / II SEMESTER
# UNIT-II: NETWORK REDUCTION AND THEOREMS

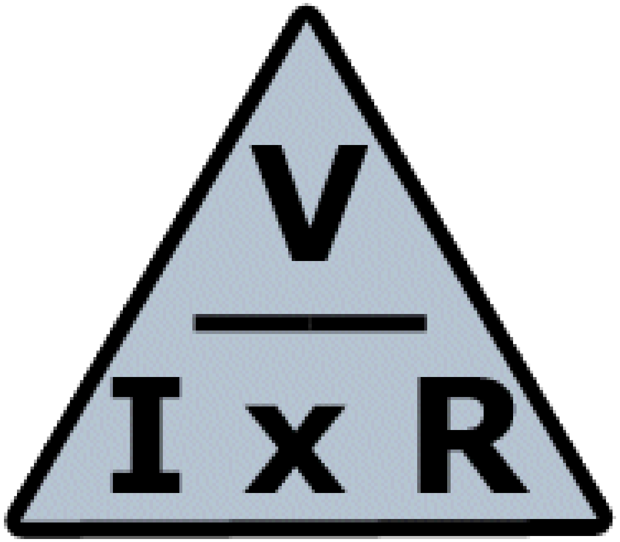
## NETWORK REDUCTION -2

# OHMS LAW - RECAP

- $V = I \times R$

- $I = \dfrac{V}{R}$

- $R = \dfrac{V}{I}$



# NETWORK REDUCTION

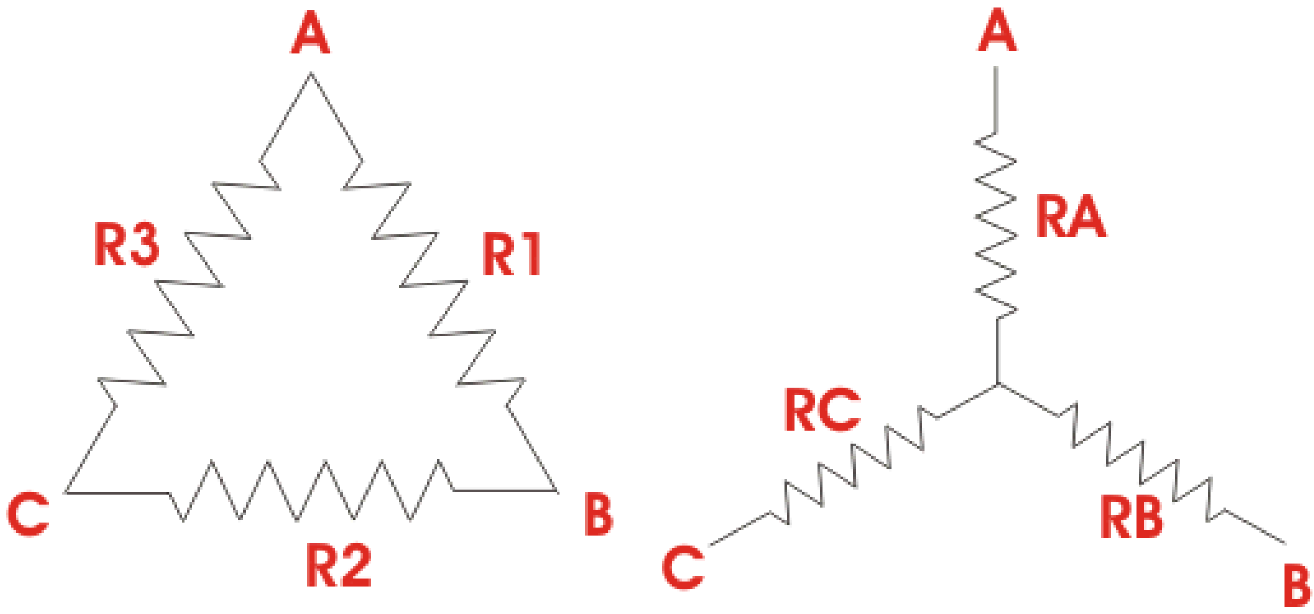
## Star-Delta Transformation

In some circuits, we cannot apply the voltage divider rule or the current divider rule directly because of the perculiar geometry of the circuit. In some cases, we may be able to transform the circuit in such a way so that after the transformation we can finally apply the voltage or the current divider rule to solve the circuit.

The following worked examples show how we can use the delta-star transformation technique together with the voltage divider and current divider rules to solve a complex circuit.

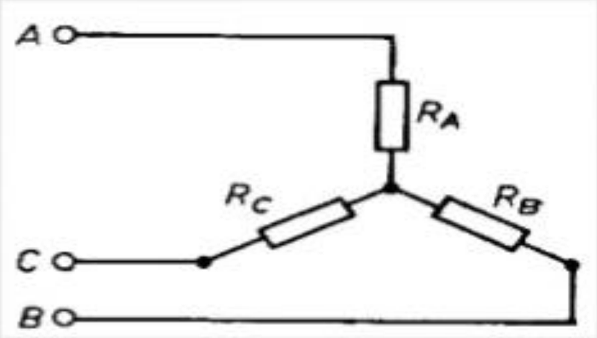
# STAR – DELTA CONVERSION

## DELTA AND STAR CONNECTED RESISTORS



# STAR – DELTA CONVERSION

Now take the star connection




The resistance between the same terminal A and C is $(R_A+R_C)$

Since terminal resistance have to be same so we must have

$$(R_A+R_C) = R_2.(R_1+R_3)/[R_2+(R_1+R_3)] \qquad (1)$$

Similarly for terminals A and B, B and C, we can have the following expression

$$(R_A+R_B) = R_3.(R_1+R_2)/[R_3+(R_1+R_2)] \qquad (2)$$
$$(R_B+R_C) = R_1.(R_2+R_3)/[R_1+(R_2+R_3)] \qquad (3)$$

# STAR – DELTA CONVERSION

Now subtracting 2 from 1 and adding the result to 3, we will get the following values for $R_1$,$R_2$ and $R_3$.

$$R_A = \frac{R_2 R_3}{R_1 + R_2 + R_3}$$

$$R_B = \frac{R_3 R_1}{R_1 + R_2 + R_3}$$

$$R_C = \frac{R_1 R_2}{R_1 + R_2 + R_3}$$

How to remember?

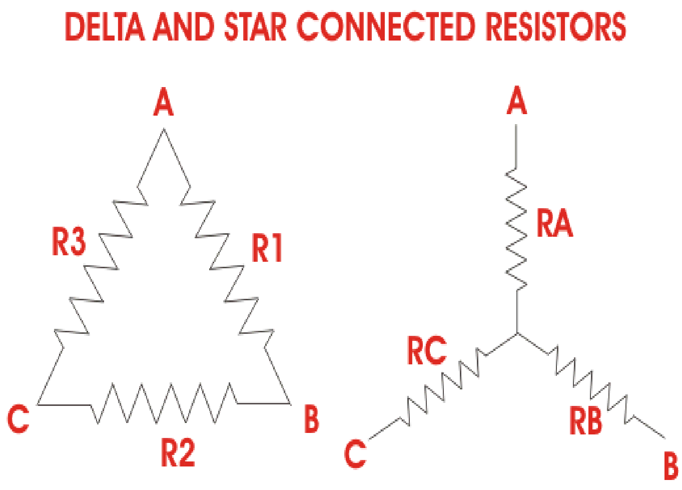
Resistance of each arm of star is given by the product of the resistance of the two delta sides that meet at its ends divided by the sum of the three delta resistance

# DELTA - STAR CONVERSION

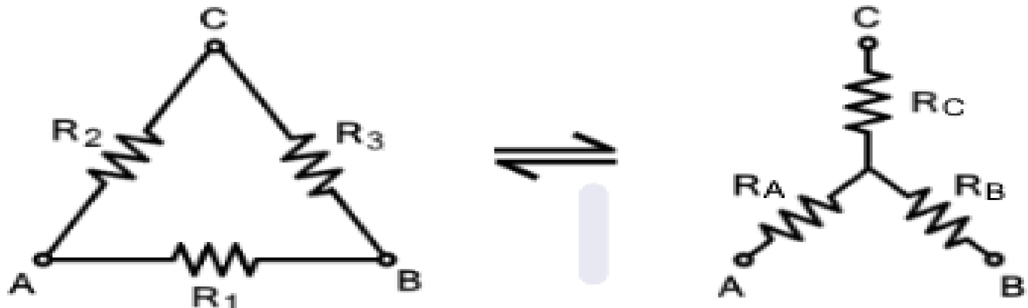
$$R_1 = \frac{R_a R_b + R_b R_c + R_c R_a}{R_b}$$

$$R_2 = \frac{R_a R_b + R_b R_c + R_c R_a}{R_c}$$

$$R_3 = \frac{R_a R_b + R_b R_c + R_c R_a}{R_a}$$

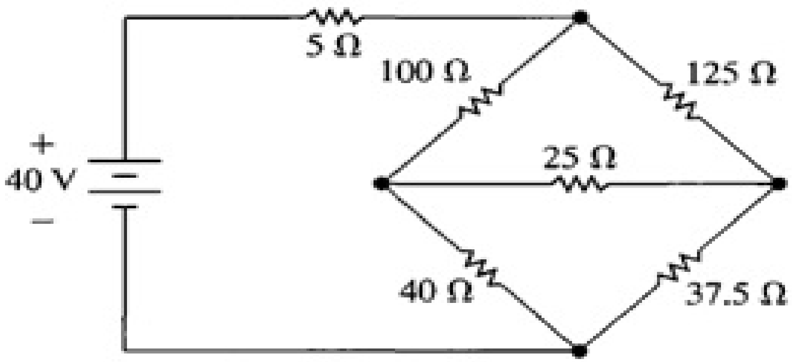


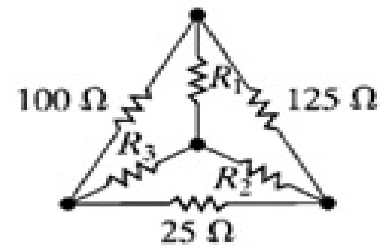
# STAR-DELTA : *nutshell*




| Delta | Star |
|---|---|
| $R_1 = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_C}$ | $R_A = \dfrac{R_1 R_2}{R_1 + R_2 + R_3}$ |
| $R_2 = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_B}$ | $R_B = \dfrac{R_1 R_3}{R_1 + R_2 + R_3}$ |
| $R_3 = \dfrac{R_A R_B + R_B R_C + R_A R_C}{R_A}$ | $R_C = \dfrac{R_2 R_3}{R_1 + R_2 + R_3}$ |
| If, $\underline{R_A = R_B = R_C = R_{star}}$<br>$R_{delta} = 3R_{star}$ | If, $\underline{R_1 = R_2 = R_3 = R_{delta}}$<br>$R_{star} = \dfrac{R_{delta}}{3}$ |

# EXAMPLE

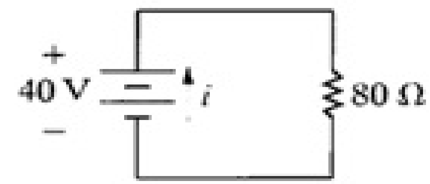


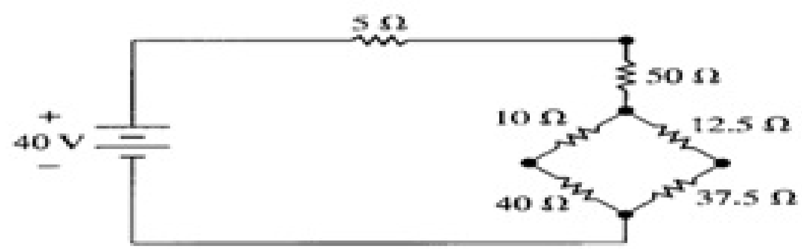

$$R_1 = \frac{100 \times 125}{250} = 50\ \Omega,$$

$$R_2 = \frac{125 \times 25}{250} = 12.5\ \Omega,$$

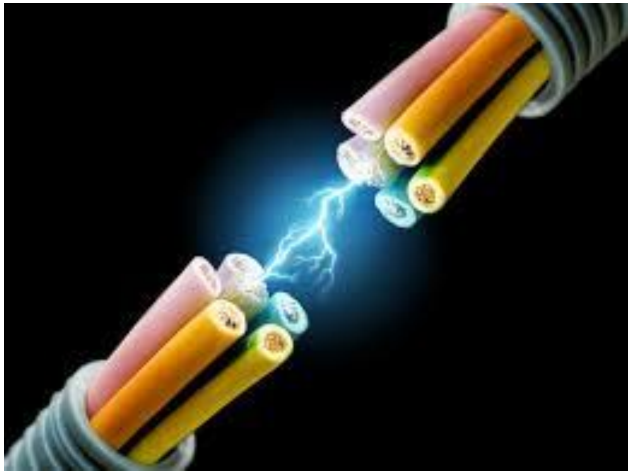
$$R_3 = \frac{100 \times 25}{250} = 10\ \Omega.$$




$$R_{eq} = 55 + \frac{(50)(50)}{100} = 80\ \Omega.$$



# MORE PROLEMS & RECAP….



# …THANK YOU