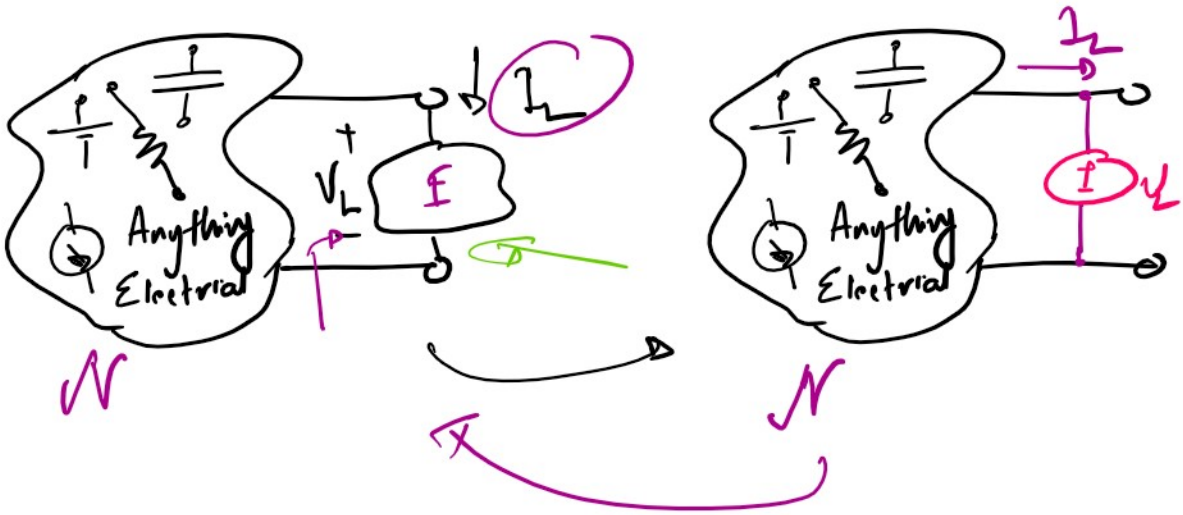
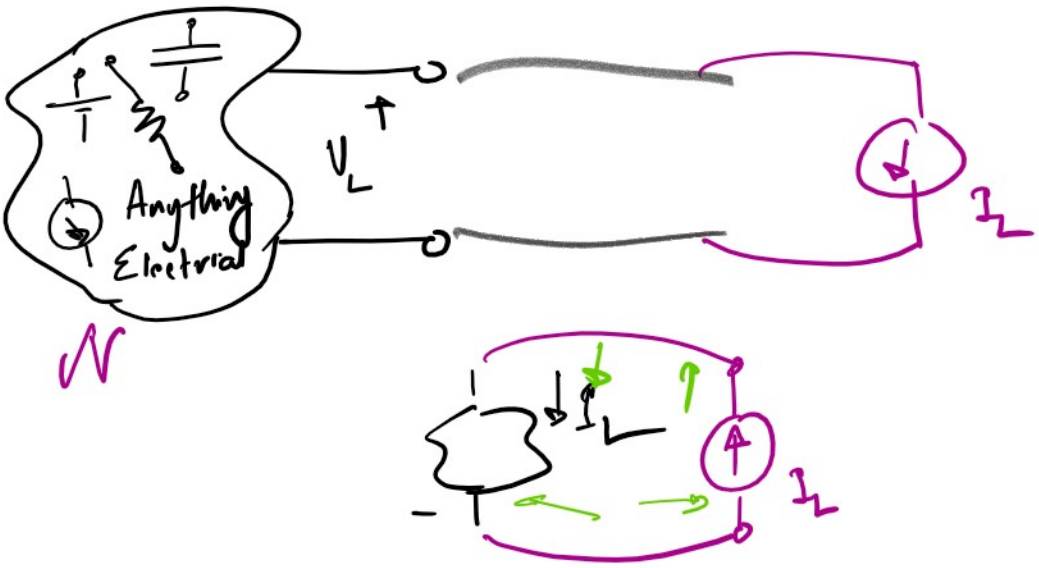
Lecture 5

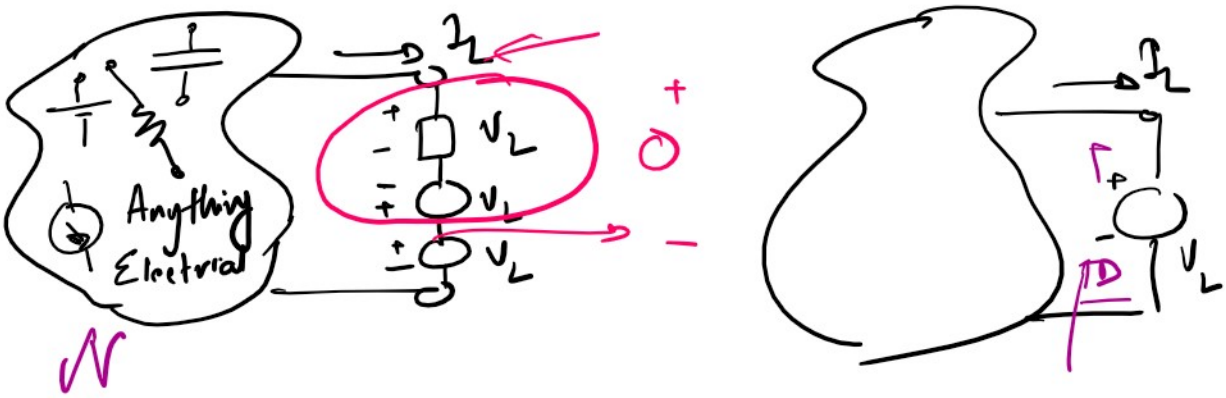
04 August 2024 23:23

# SUBSTITUTION THEOREM

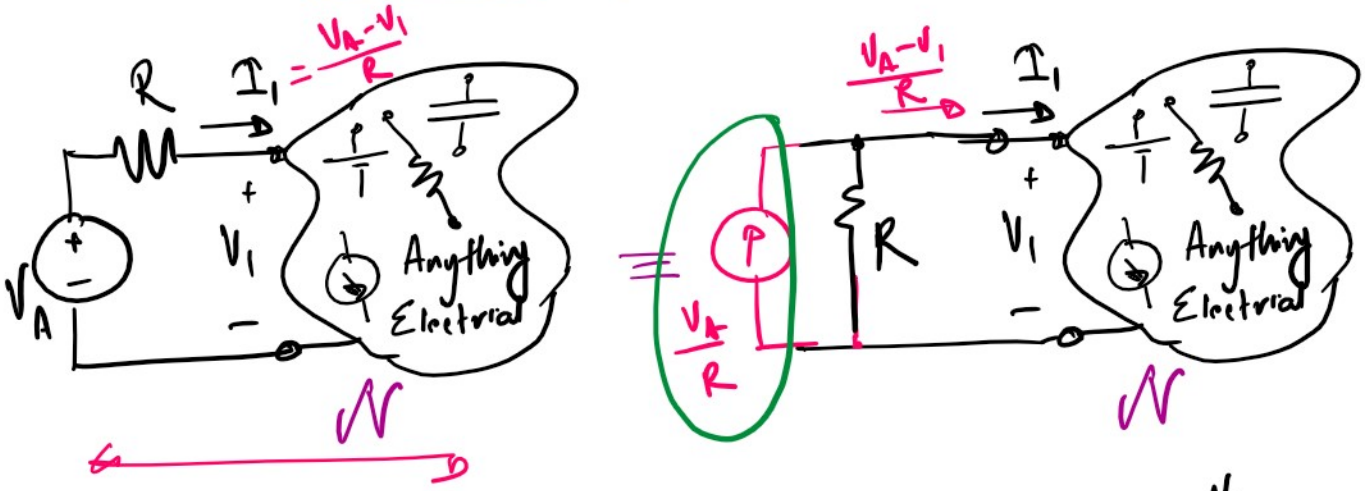



**If an element is replaced by a voltage source with the same voltage or a current source with the same current, the rest of the circuit remains unchanged.**

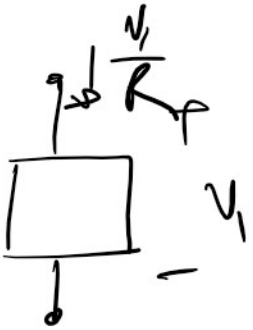


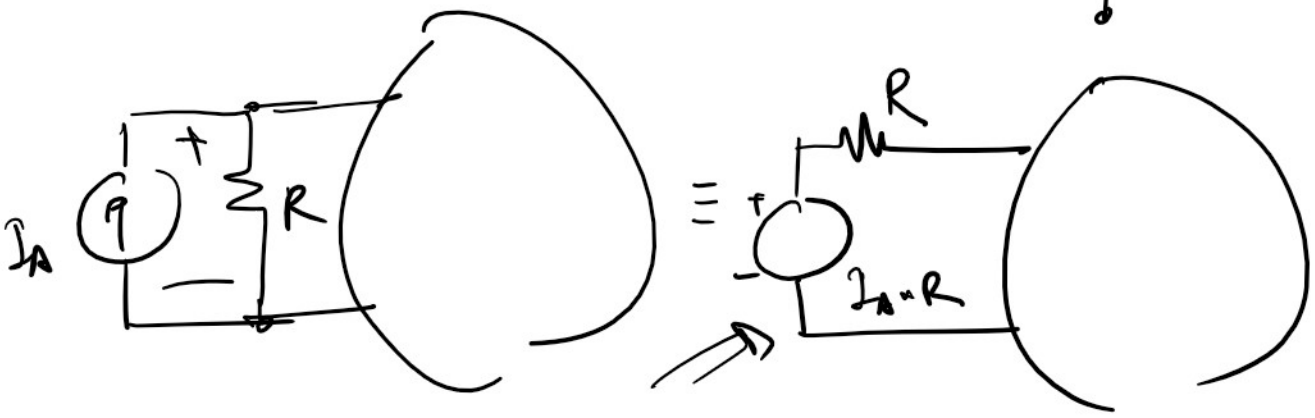



# SOURCE TRANSFORMATION

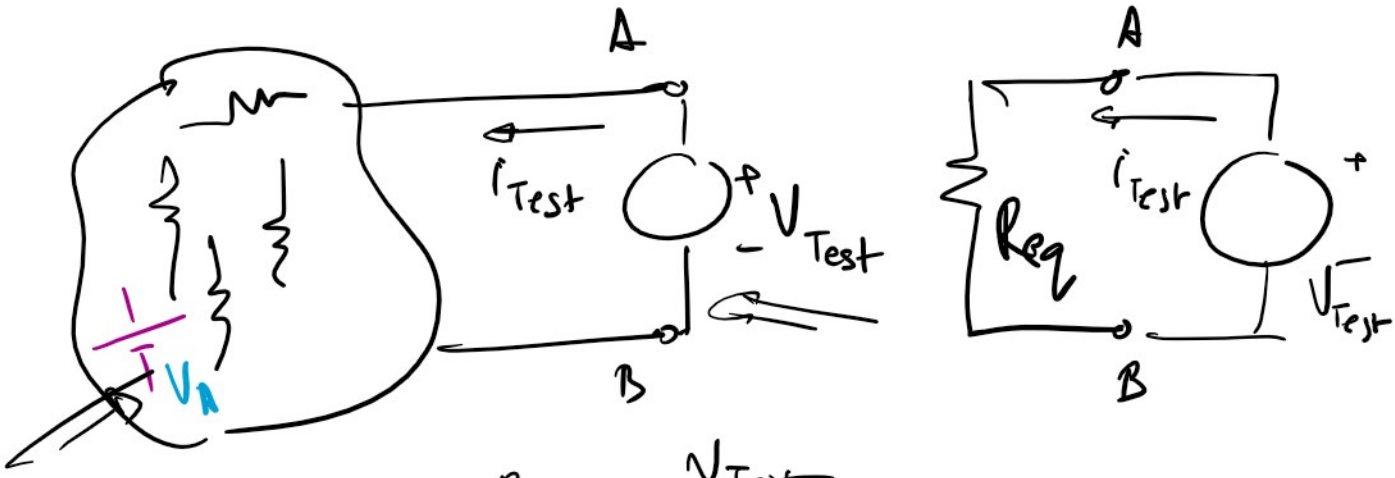



$$I_1 = \frac{(V_A - V_1)}{R} = \left(\frac{V_A}{R}\right) - \left(\frac{V_1}{R}\right)$$



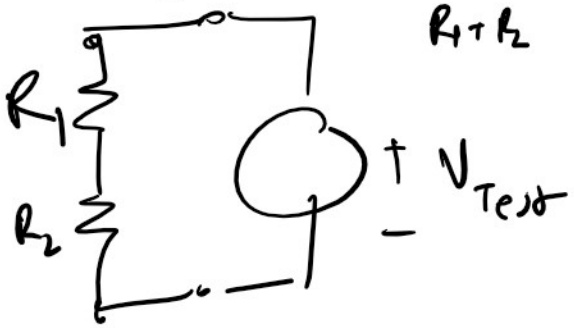
# EQUIVALENT RESISTANCE

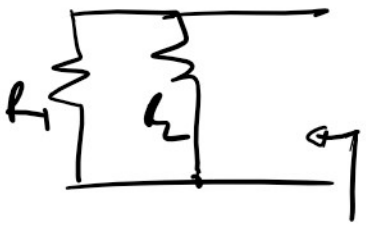



$$R_{eq} = \frac{V_{Test}}{i_{Test}}$$

$$i_{Test} = \alpha V_{Test} + \beta V_A$$

$$i_{Test} = \frac{V_{Test}}{R_1 + R_2} \Rightarrow R_{eq} = \frac{V_{Test}}{i_{Test}} = R_1 + R_2$$




$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

# THEVENIN'S THEOREM

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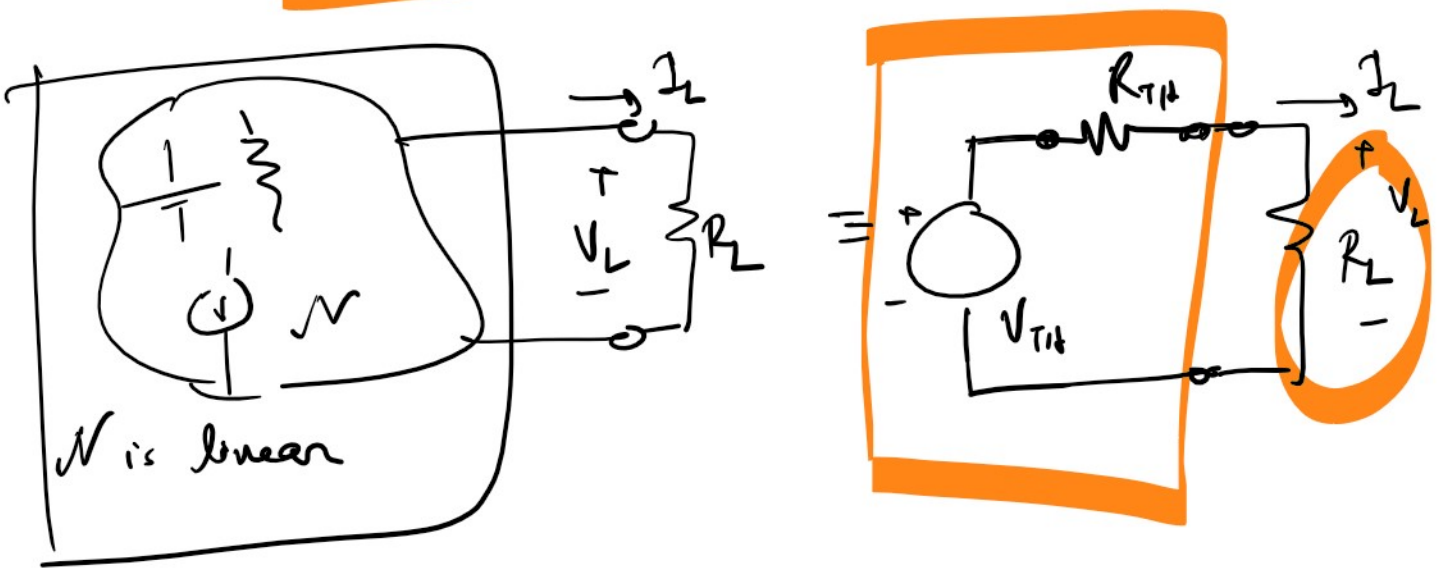
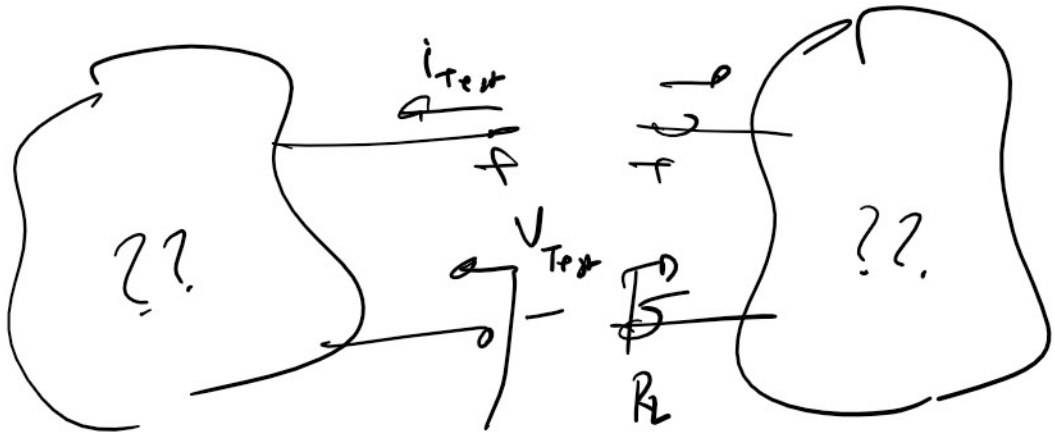
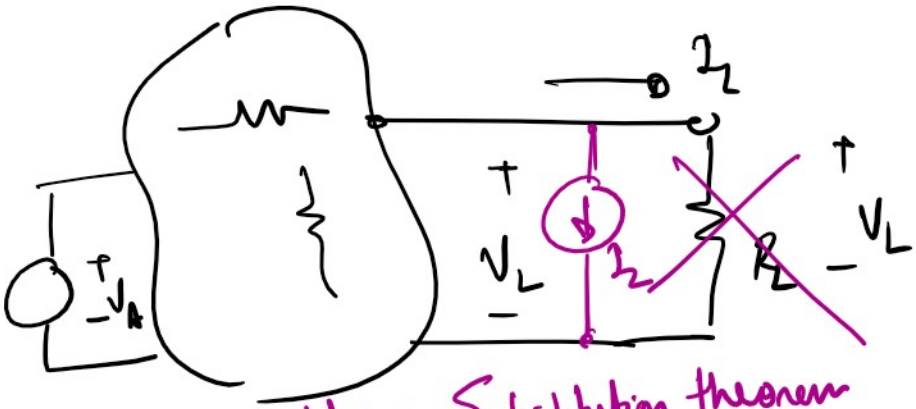


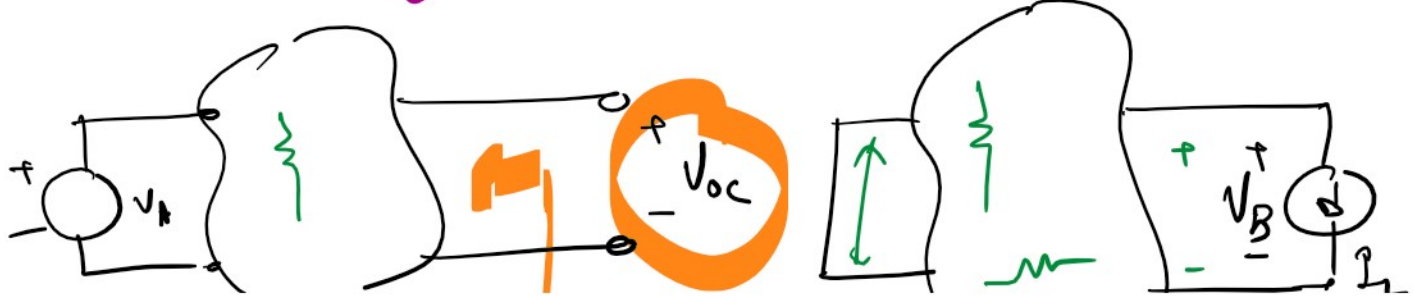



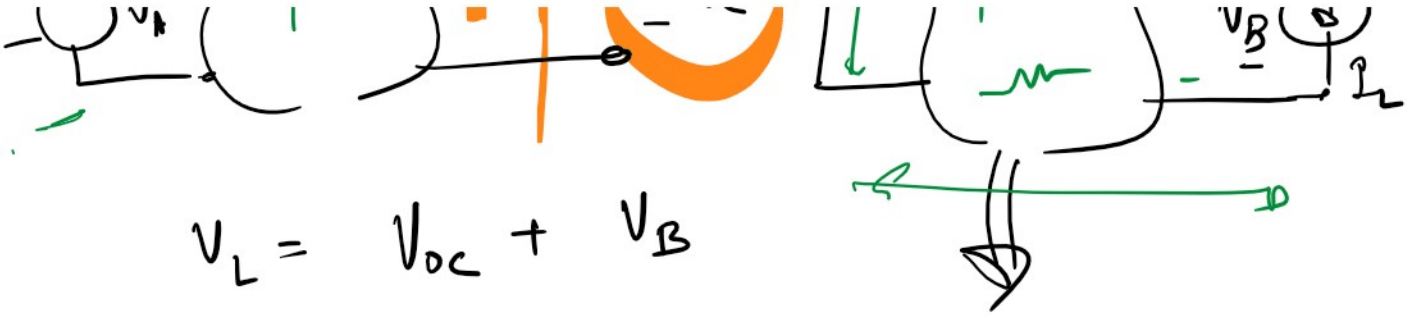




$V_L = I_L R_L$

$$I_L = \frac{V_L}{R_L}$$

Using Substitution theorem

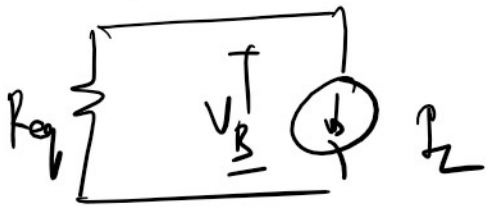




$$V_L = V_{oc} + V_B$$

$$= V_{oc} - R_{eq} I_L$$

$$= V_{oc} - \frac{R_{eq} V_L}{R_L}$$



$$\Rightarrow V_L \left(1 + \frac{R_{eq}}{R_L}\right) = V_{oc}$$

$$\Rightarrow \boxed{V_L = \frac{V_{oc} \; R_L}{R_{eq} + R_L}}$$