FORMULAS DC

$i = G \cdot U$

$GU = i - GE$

Voltage divider (4)

→ Series

$$\left.\begin{array}{l} U_{R_1} = R_1 \cdot i \\ i = \dfrac{U}{R_{eq}} \end{array}\right\} \Rightarrow U_{R_1} = \frac{R_1}{R_{eq}} \cdot U = \frac{R_1}{\sum_{m=1}^{m} R_k} \cdot U$$

$$\boxed{U_{R_k} = \frac{R_k}{\sum_{k=1}^{m} R_k} \cdot U}$$

→ Parallel

$$\frac{U}{R_{eq}} = \frac{U}{R_1} + \frac{U}{R_2} + \dots + \frac{U}{R_m} \Rightarrow R_{eqP} = \frac{1}{\sum_{k=1}^{m} \frac{1}{R_k}}$$

Current divider (5)

$$i = \frac{U}{R_1} = \frac{i \cdot R_{eq}}{R_1} = \frac{i}{R_1} \cdot \frac{1}{\sum_{k=1}^{m} \frac{1}{R_k}} \Rightarrow \boxed{i_k = i \cdot \frac{1}{R_k \cdot \sum_{1}^{m} \frac{1}{R_k}}}$$

$$U = R_1 i_1 = R_2 i_2 = i \cdot \frac{R_1 R_2}{R_1 + R_2} \qquad i_2 = \frac{i R_1}{R_1 + R_2} \qquad i_1 = \frac{i R_2}{R_1 + R_2}$$

Theorems of equivalent transformation (7)

1). Series

(⇔)

$G = \frac{1}{R}$

$i_s = \frac{E}{R}$

2).

(⇔)

$R_e = R$

$E_e = E + R \cdot i_s$

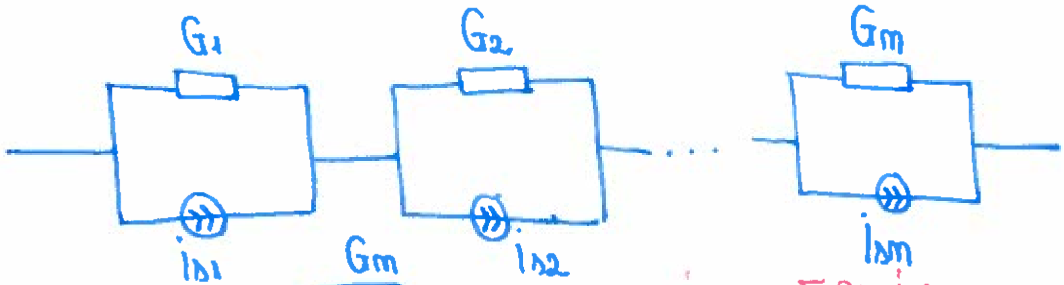
$G_e = \frac{1}{R}$

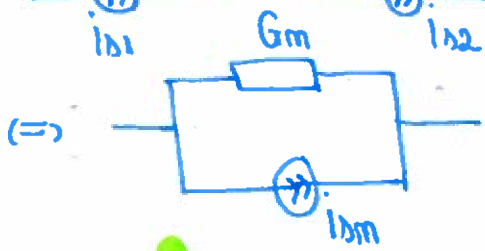
$i_{se} = i_s + \frac{E}{R}$

3.a).

$$R_e = \sum_{k=1}^{m} R_m \qquad E_e = \sum_{k=1}^{m} E_k$$

b).





$$i_{sk} = \frac{\sum R_k \cdot i_{sk}}{\sum R_k} \qquad G_k = \frac{1}{\sum \frac{1}{G_k}}$$

Kirchoff Theoremes

→ T_1 : $\sum_{k=1}^{m} i_K = 0$ → { + exit, − enter } → N nodes ⊖ (N-1) times

→ consequence of electric charge conservation app closed surf. Σ
"+" dir = $\vec{n}$ ↷ surface the outward one

T_2 → $\sum U_K = 0 \Leftrightarrow \sum R_K i_K = \sum E_K$

→ In case current sources, K_2 will contain the voltage dr

→ K_2 = conseq. of law of electric conduction / Faraday's law referring to the electromotive force along a closed path under

The Theorem of Power Conservation (8)

It says that the total electric power generated by all voltage, respectively current sources of the circuit, is equal to the total electric power used by the passive elements (resistor

$$P_{gen} = P_{rec} \qquad P_{gen} = \sum_{k=1}^{m} (E_k i_k + U_{sk} i_{sk})$$

$$\sum R_k \cdot i_k^2 = \sum E_k i_k + U_{sk} i_{sk}$$

The total power (exchanged power) at the level of a closed ideal circuit is 0. $P = P_{gen} - P_{rec} = 0$

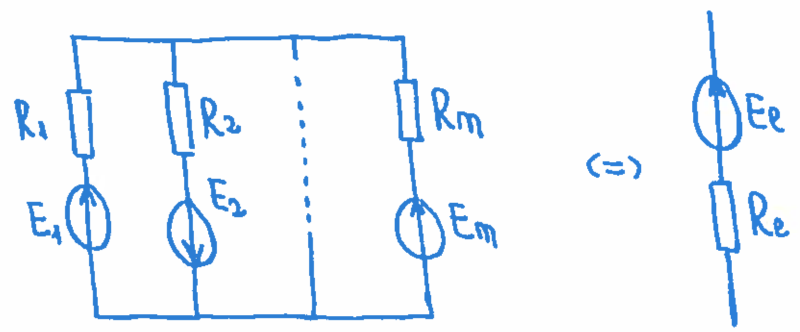
Theorem of the maximum power transfer (9)

$$P = R_2 i_2^2 = \frac{E^2 R_2}{(R_2 + R_i)^2}$$

To find the maximum power differentiate the above expression with respect to resistance R_2 and equate it to zero.

$$\frac{dP}{dR_2} = 0 \Rightarrow R_2 = R_i$$

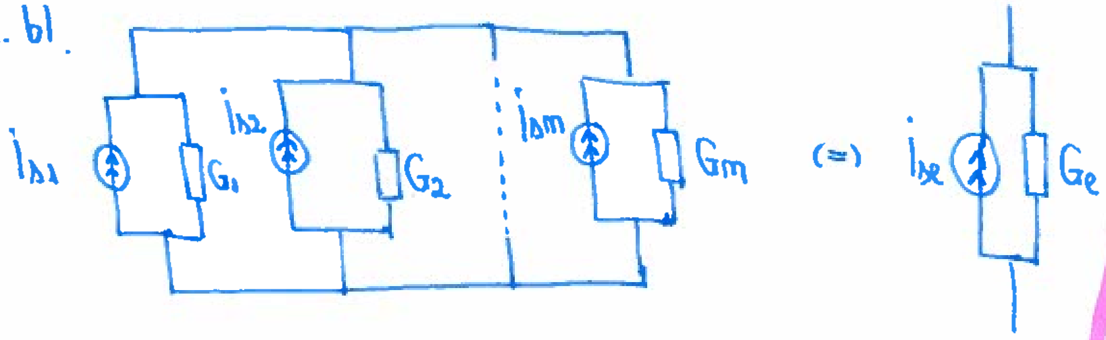
4a).



$$E_e = \frac{\sum E_k G_k}{\sum G_k}$$

$$R_e = \frac{1}{\sum_{k=1}^{m} \frac{1}{R_k}}$$

4. b)



$$G_e = \sum G_k$$

$$i_{se} = \sum_{k=1}^{m} i_{sk} \text{ alg.}$$