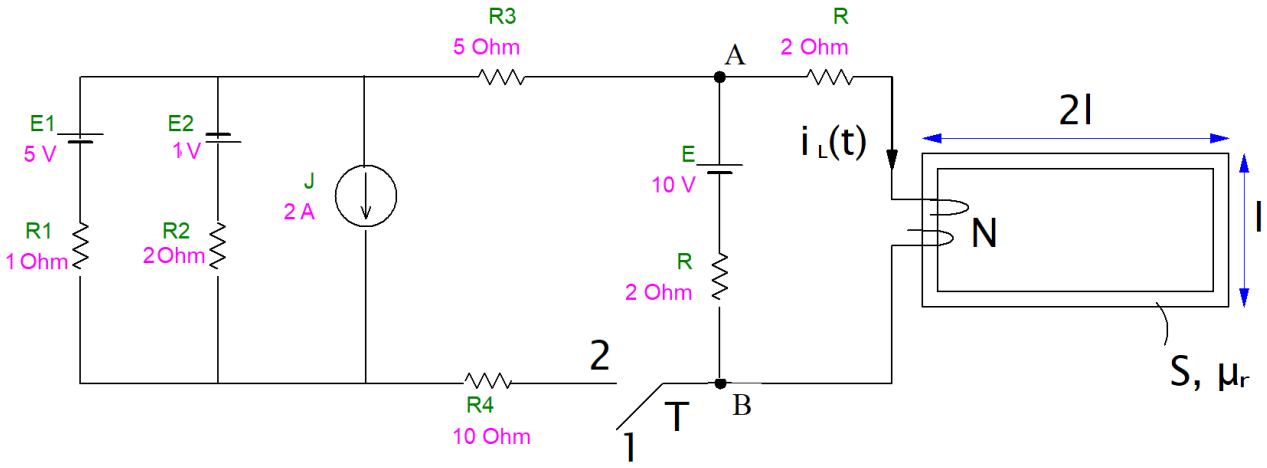
ESERCIZIO 17 FEBBRAIO 2022

Nome e Cognome: _____matricola:_____

Corso di Laurea:_____

Es.1 – All'istante t=0 sec, il tasto T si chiude. Determinare l'andamento temporale di $i_L(t)$. Inoltre, determinare l'andamento temporale della tensione tra i punti A e B (considerando il ramo con R - L).

l=0.35cm; S=4cm²; N=125; μ_r=800



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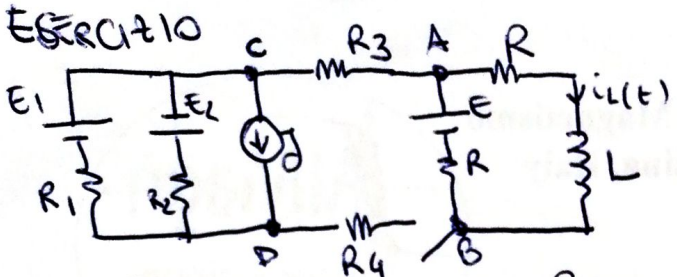
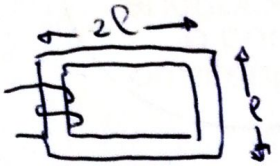
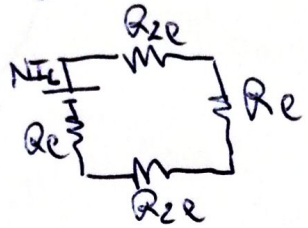


#1





$$Re = \frac{l}{\mu_0 \mu_r S}$$

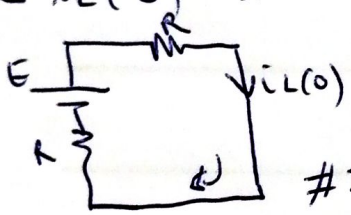
$$R_{2e} = \frac{2l}{\mu_0 \mu_r S}$$

$$Req = 2\,Re + 2\,R_{2l}$$

$$L = \frac{N^2}{Req}$$

$$i_L(t) = i_L(0)\, e^{-t/\tau} + i_L(\infty)\left(1 - e^{-t/\tau}\right)$$

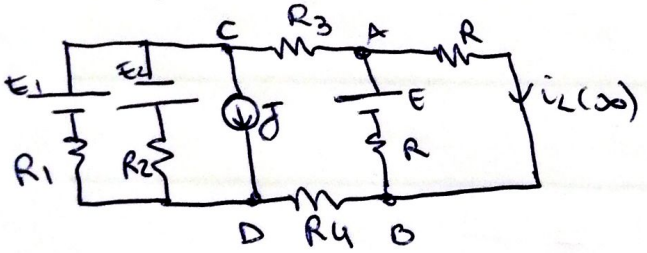
- $i_L(0)$ ⇒ T aperto ⇒ L.c.c



#2

$$i_L(0) = \frac{E}{2R}$$

- $i_L(\infty)$ ⇒ T chiuso ⇒ L.c.c

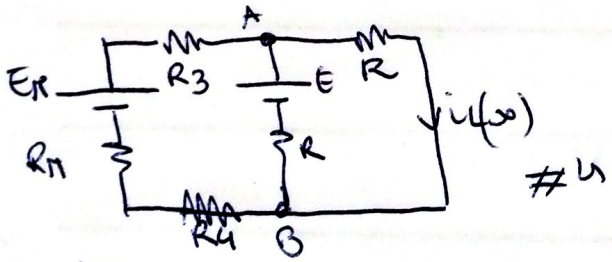


#3

Applico Millmann tra C e D

$$E_M = \frac{\frac{E_1}{R_1} - \frac{E_2}{R_2} - J}{\frac{1}{R_1} + \frac{1}{R_2}}$$

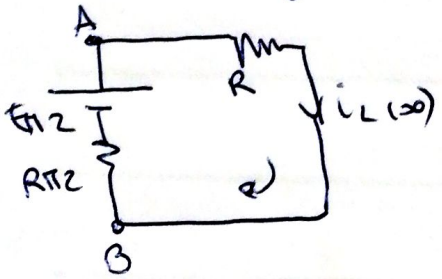
$$R_M = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$



#4

Applico Millmann tra A - B:

$$E_{M2} = \frac{\frac{E_M}{R_M + R_3 + R_4} + \frac{E}{R}}{\frac{1}{R_M + R_3 + R_4} + \frac{1}{R}}$$



#5

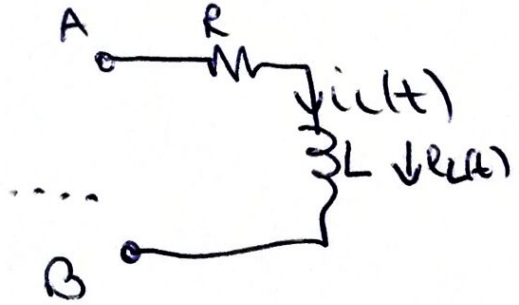
$$R_{M2} = \frac{1}{\frac{1}{R_M + R_3 + R_4} + \frac{1}{R}}$$

$$i_L(\infty) = \frac{E_{M2}}{R_{M2} + R}$$

- Calcolo di $\tau = \frac{L}{R_L}$. Dal #5

⇒ $R_L = R_{M2} + R$ oppure dal #3 ⇒ $R_L = \{[(R_1 // R_2) + R_3 + R_4] // R\}$

Procedo con il calcolo di $v_{AB}(t) + v_L(t) = R\, i_L(t)$



$$i_L(t) = i_L(0)\, e^{-t/\tau} + i_L(\infty)\left(1 - e^{-t/\tau}\right) =$$

$$= i_L(\infty) + \left(i_L(0) - i_L(\infty)\right) e^{-t/\tau}$$

$$v_L = -L\frac{di_L}{dt} = -L\left[i_L(0) - i_L(\infty)\right] e^{-t/\tau} \cdot \left(-\frac{1}{\tau}\right) = R_L\left[i_L(0) - i_L(\infty)\right] e^{-t/\tau}$$

$$v_{AB}(t) = R\left[i_L(0)\, e^{-t/\tau} + i_L(\infty)\left(1 - e^{-t/\tau}\right)\right] - R_L\left[i_L(0) - i_L(\infty)\right] e^{-t/\tau} =$$

$$= R\, i_L(0)\, e^{-t/\tau} + R\, i_L(\infty)\left[1 - e^{-t/\tau}\right] - R_L\, i_L(0)\, e^{-t/\tau} + R_L\, i_L(\infty)\, e^{-t/\tau} =$$

$$= i_L(0)\, e^{-t/\tau}\left[R - R_L\right] + R\, i_L(\infty) + R_L\, i_L(\infty)\, e^{-t/\tau}\left[R_L - R\right]$$