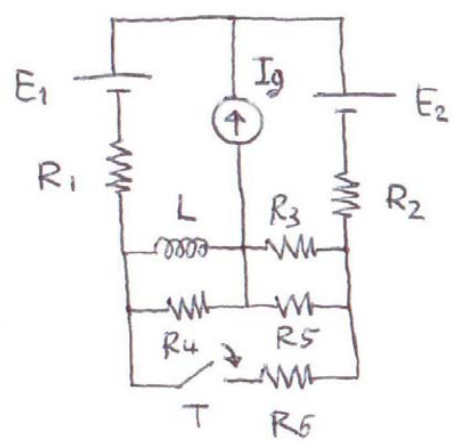
COMPITO DI ELETTROTECNICA 08/01/2019

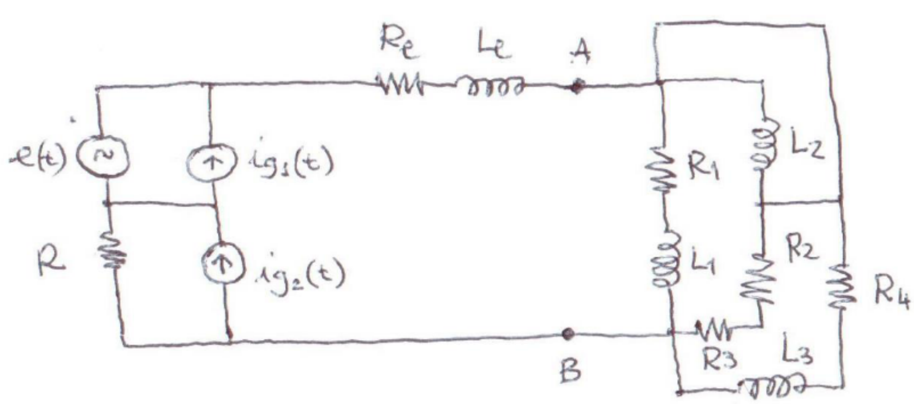
Studente ____ Matricola __________________

Corso di Laurea ____

1. Il circuito in figura si trova in condizioni di regime. All'istante t=0s il tasto T si chiude. Determinare l'andamento temporale della corrente che scorre nell'induttore e l'energia immagazzinata in esso dopo 20ms e dopo 100ms dalla chiusura del tasto.
E_1=10V, E_2=4V, I_g=0.2A, R_1=1Ω, R_2=1Ω, R_3=5Ω, R_4=2Ω, R_5=2Ω, R_6=2Ω, L=1mH.



2. Dato il circuito in figura, determinare la potenza attiva richiesta dalla resistenza di linea R_l e la capacità da inserire tra i punti A e B per rifasare il carico a valle a cosϕ=0.98.
e(t)=10sen(ωt+π/6) V, i_{g1}(t)=sen(ωt) A, i_{g2}(t)=cos(ωt) A, ω=100rad/sec, R=1Ω, R_l=2Ω, R_1=5Ω, R_2=1 Ω, R_3=9 Ω, R_4=4 Ω, L_1=0.1 mH, L_2=0.2 mH, L_3=1 mH.



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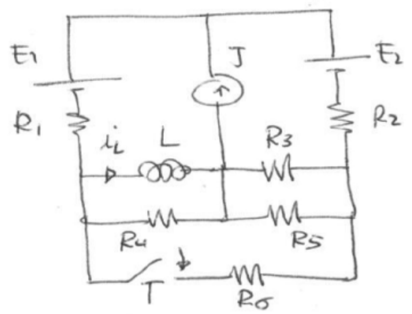
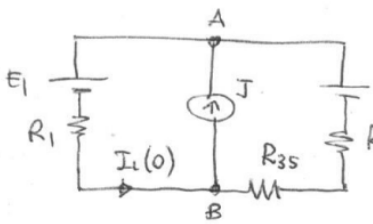
Es. 1



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

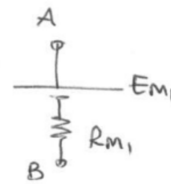
$$W_L = \frac{1}{2} L\, i_L^2$$

$I_L(0)$: $L \to$ c.c. ; $R_4 \,//\,$ c.c. si trascura R_4 ; T aperto



$$R_{35} = \frac{1}{\frac{1}{R_3} + \frac{1}{R_5}}$$

⇒



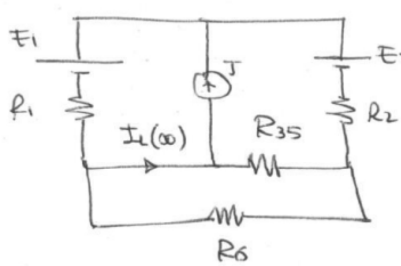
$$E_{M1} = \frac{\frac{E_1}{R_1} + J + \frac{E_2}{R_2 + R_{35}}}{\frac{1}{R_1} + \frac{1}{R_2 + R_{35}}}$$

$V_{AB} = E_{M1}$

$V_{AB} = E_1 + R_1 \cdot I_L(0) \Rightarrow$

$$\boxed{I_L(0) = \frac{V_{AB} - E_1}{R_1}}$$

$I_L(\infty)$: T chiuso ; $L \to$ c.c. ; R_4 si trascura ancora



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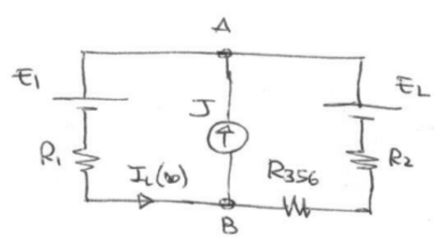
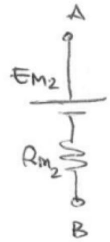


$$R_{356} = \frac{1}{\frac{1}{R_{35}} + \frac{1}{R_6}}$$

seguendo stesso procedimento di prima:

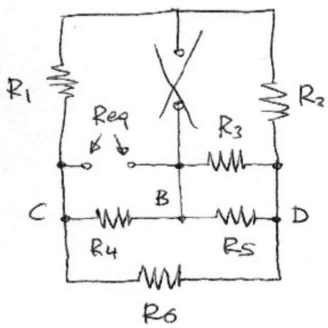


$$V_{AB_\infty} = E_{M2} = \frac{\frac{E_1}{R_1} + J + \frac{E_2}{R_2 + R_{356}}}{\frac{1}{R_1} + \frac{1}{R_2 + R_{356}}}$$

$$\boxed{I_L(\infty) = \frac{V_{AB_\infty} - E_1}{R_1}}$$

$$\tau = L / R_{eq}$$

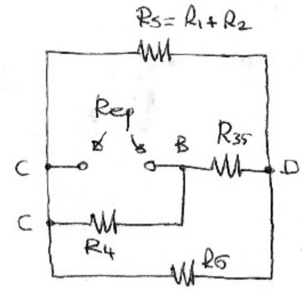
R_{eq} resistenza vista da L dopo la chiusura di T



R_1 e R_2 in serie

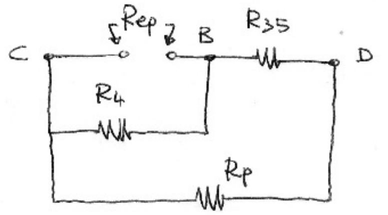
R_3 e R_5 in parallelo

⟹



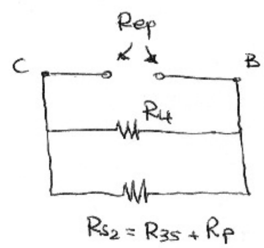
$$R_{35} = \frac{R_3 R_5}{R_3 + R_5}$$

R_s e R_6 in parallelo tra C e D ⟹



$$R_p = \frac{R_s R_6}{R_s + R_6}$$

R_{35} e R_p in serie ⟹



$$R_{eq} = R_4 + R_{s2}$$

⟹ $$\tau = L / R_{eq}$$

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Es. 2

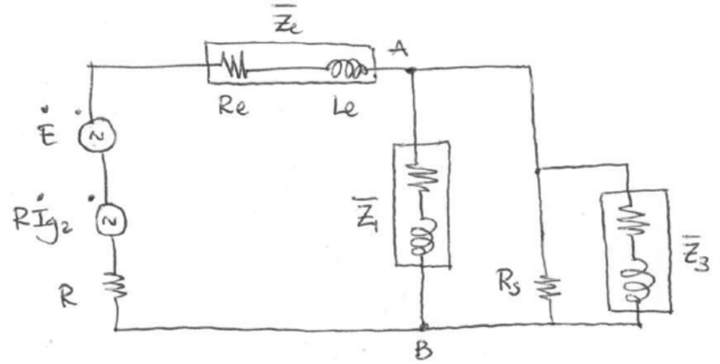
Trasformo il circuito nel dominio dei fasori.

$i_{g1}(t)$ è trascurabile poiché $e(t)$ è prevalente.

$$\dot{E} = \frac{10}{\sqrt{2}}\cos\frac{\pi}{6} + j\,\frac{10}{\sqrt{2}}\sin\frac{\pi}{6} \ \text{V}$$

$$i_{g2}(t) = \cos(\omega t) = \sin\left(\omega t + \frac{\pi}{2}\right) \Rightarrow \dot{I}_{g2} = \frac{1}{\sqrt{2}}\cos\frac{\pi}{2} + j\,\frac{1}{\sqrt{2}}\sin\frac{\pi}{2} = j\,\frac{\sqrt{2}}{2} \ \text{A}$$

Trasformo il generatore reale di corrente $\dot{I}_{g2} - R$ in tensione



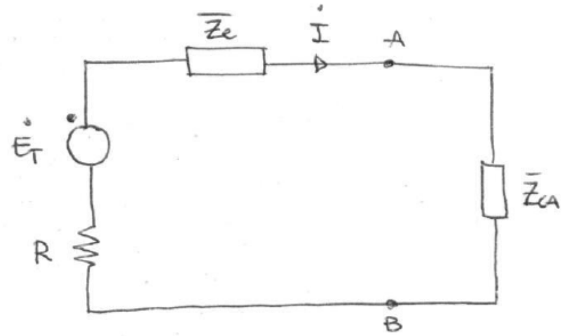
$\bar{Z}_e = R_e + j\omega L_e$

$\bar{Z}_1 = R_1 + j\omega L_1$

L_2, in parallelo a corto, si trascura

$R_S = R_2 + R_3$

$\bar{Z}_3 = R_4 + j\omega L_3$



$$\dot{E}_T = \dot{E} + R\dot{I}_{g2}$$

$$\bar{Z}_{CA} = \frac{1}{\frac{1}{\bar{Z}_1} + \frac{1}{R_S} + \frac{1}{\bar{Z}_3}}$$

$$\dot{I} = \frac{\dot{E}_T}{R + \bar{Z}_e + \bar{Z}_{CA}} \Rightarrow \boxed{P_{R_e} = R_e|\dot{I}|^2 = R_e I^2}$$

$$\bar{S}_{AB} = \dot{V}_{AB}\check{I} = \bar{Z}_{CA}\dot{I}\check{I} = \bar{Z}_{CA} I^2 = P_{CA} + jQ_{CA}$$

Se è necessario rifasare, $\boxed{C_R = \frac{Q_{CA} - P_{CA}\,tg\,\phi_R}{\omega V_{AB}^2}}$