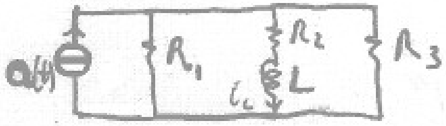
4) Calcolare e disegnare l'andamento della ***variabile di stato*** in $-\infty < t < +\infty$
[Dati: a(t)=5 [u(t)-u(t-2)], u(t) è la funzione gradino unitario, R1=R3=4 Ω, R2=2 Ω]



t<0 $\quad i_L = 0$ A

t=0+ $\quad i_L(0_-) = i_L(0_+) = 0$ A

0<t<2 $\quad \tau = \frac{L}{R_{eq}} = \frac{L}{4}$ sec

$R_{eq} = R_2 + R_1 \| R_3 = 4\,\Omega$

t->∞*

$i_{L\infty^*} = 5 \cdot \frac{G_2}{G_1+G_2+G_3} =$

* regime fittizio

$i_{L\infty^*} = 5 \cdot \frac{1/2}{\frac{1}{4}+\frac{1}{2}+\frac{1}{4}} = \frac{5}{2}$ A

$$\boxed{i(t) = \frac{5}{2}\left(1-e^{-4t/L}\right), \quad 0<t<2}$$

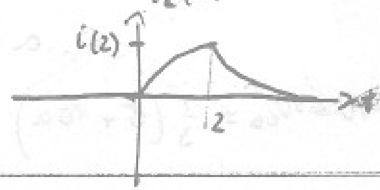
$i(2^-) = \frac{5}{2}\left(1-e^{-8/L}\right) = i(2^+)$

$\tau = \frac{L}{R_{eq}} = \frac{L}{4}$ stessa costante di tempo

t->∞ $\quad i_L(\infty) = 0$

$i(t) = i(2^+)\, e^{-\frac{4(t-2)}{L}} = \frac{5}{2}\left(1-e^{-8/L}\right) e^{-\frac{4(t-2)}{L}} \quad t>2$

$$i_L(t) = \begin{cases} 0 & t<0 \\ \frac{5}{2}\left(1-e^{-\frac{4t}{L}}\right) & 0<t<2 \\ \frac{5}{2}\left(1-e^{-8/L}\right) e^{-\frac{4(t-2)}{L}} & t>2 \end{cases}$$

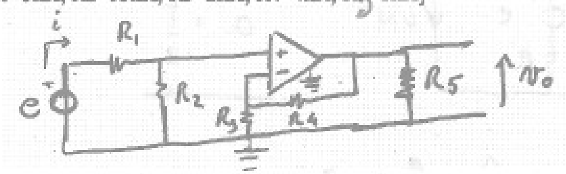


COGNOME (IN STAMPATELLO)	NOME	MATRICOLA	ELT I 17/07/2007	TEMPO 1h10' 3 esercizi su 4 a scelta	

Per ogni esercizio riportare sia il risultato che il procedimento utilizzato (utilizzare solamente questo foglio, che va riconsegnato al termine della prova).

1) Dato il circuito in figura
a) Calcolare *Vo*.
b) Calcolare il rapporto tra la potenza dissipata da R5 e la potenza erogata dal generatore indipendente
c) Giustificare il risultato ottenuto al punto b)

[Dati: e=6V, R1=5kΩ, R2=15kΩ, R3=2kΩ, R4=4kΩ, R5=1kΩ]



a) $V_+ = e \cdot \frac{15K}{15K+5K} = 6 \cdot \frac{15}{20} = \frac{9}{2}$ V

$V_o = \left(1+\frac{R_4}{R_3}\right) V_+ = \left(1+\frac{4}{2}\right)\frac{9}{2} = \frac{27}{2}$ V

b) $P_{diss} = \frac{V_o^2}{R_5} = \left(\frac{27}{2}\right)^2 \frac{1}{R_5} = 0.18225$ W

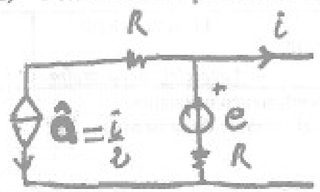
$P_{erogata} = e \cdot i = 6 \cdot 3 \cdot 10^{-4} = 1.8$ mW

$i = \frac{e}{R_1+R_2} = \frac{6}{20}$ mA $= 0.3$ mA

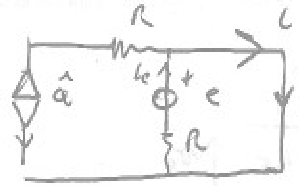
$\frac{P_{diss}}{P_{erogata}} = \frac{0.18225}{0.0018} = 101.25$

c) Amplificatore non invertente è un componente/circuito attivo

2) Determinare l'equivalente Norton



i_N)

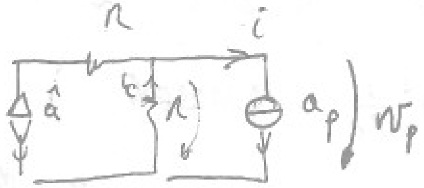


$\hat{a} = \frac{i}{2}$

$i_e = \hat{a} + i = \frac{3i}{2}$

$i_e = \frac{e}{R} \Rightarrow i = \frac{2}{3} i_e = \frac{2e}{3R} = i_N$

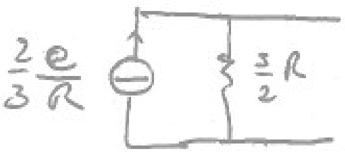
R_N)



$i_e = i + \underbrace{\frac{i}{2}}_{\hat{a}} = \frac{3}{2} i$

$v_p = i_e \cdot R = \frac{3}{2} i R = \frac{3}{2} a_p R$

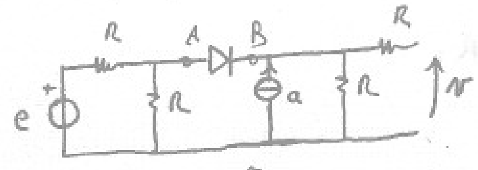
$R_{eq} = R_N = \frac{v_p}{a_p} = \frac{3}{2} R$



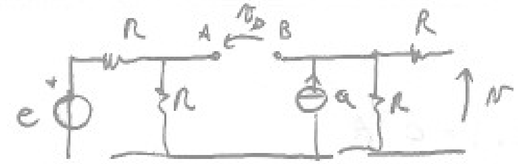
3) Dato il circuito in figura

Determinare la caratteristica $v=v(a)$

[Dati: R=10 Ω, e=5V]



OFF

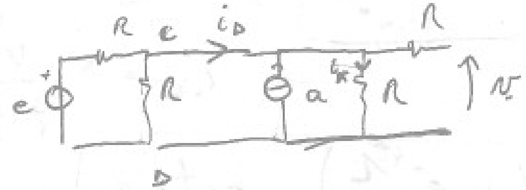


$v_D < 0$

$v_D = \frac{e}{2} - aR < 0 \Rightarrow a > \frac{e}{2R} = \frac{1}{4}$ A

$v = v(a)$ $\boxed{v = aR = 10a}$

ON



$i_D > 0$

Millmann $v_{CD} = \frac{\frac{e}{R} + a}{\frac{1}{R}+\frac{1}{R}+\frac{1}{R}} = \frac{R}{3}\left(\frac{e}{R}+a\right) = \frac{1}{3}(e + aR)$

$\boxed{i_D = i_x - a}$ $i_x = \frac{v_{CD}}{R}$

$\Rightarrow i_D = \frac{1}{3R}(e + aR) - a \Rightarrow i_D = \frac{1}{3R}(e - 2aR) > 0$

$\Rightarrow a < \frac{e}{2R} = \frac{1}{4}$ A

$v = v_{CD} = \frac{1}{3}(5 + 10a)$