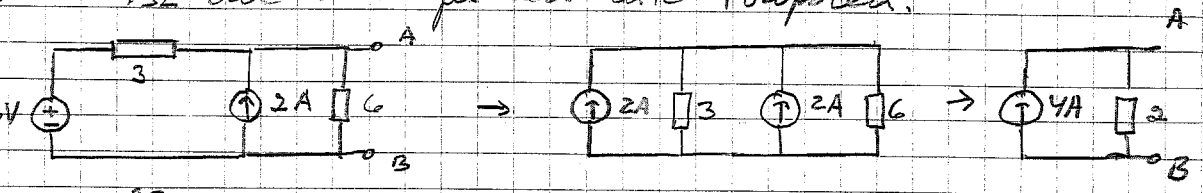
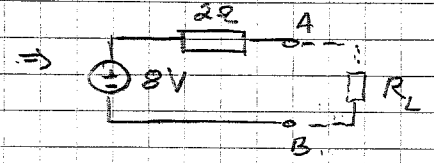
Lösningen till tentamen i Elektriska kretsar och signaler del A för D2 030821 EP

1/ a/ 4Ω och 2Ω påverkar inte tvåpolen.





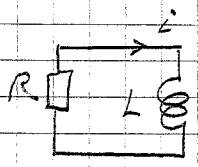
$\frac{6 \cdot 3}{6+3} = 2$

b/ Anpassning P_L max för $R_L = 2\,\Omega$

c/ $P_{L\,max} = R_L i^2 = 2 \cdot \left(\frac{8}{2+2}\right)^2 = \underline{\underline{8\ W}}$

2/ $t < 0$ L utgör kortslutning $\Rightarrow i(0) = i_0$

$t > 0$



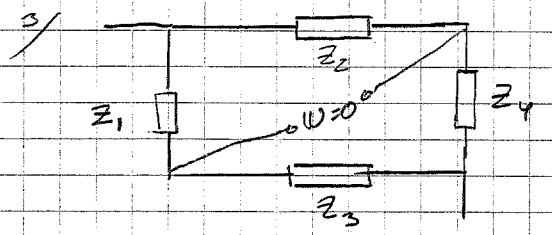
KVL $Ri + L\frac{di}{dt} = 0$

$\frac{di}{dt} + \frac{R}{L} i = 0$ (1)

ansats $i(t) = K_1 + K_2 e^{-t/\tau}$ (2) ins i (1) $\Rightarrow \tau = \frac{L}{R}$

$K_1 = 0$; BV: $i(0) = K_2 = i_0 \Rightarrow \underline{i(t) = i_0 e^{-Rt/L}}$ $t \geq 0$

3/



Wheatstone-brygga i balans för $\frac{Z_1}{Z_3} = \frac{Z_2}{Z_4}$ (1)

$\omega = ?$ $R_1/R_2 = ?$

Låt $Z_1 = R_1$, $Z_2 = R_2$, $Z_3 = R_3 + \frac{1}{j\omega C_3}$, $Z_4 = \frac{R_4}{1 + j\omega R_4 C_4}$

ins i (1) $\Rightarrow \frac{R_1}{R_2} = \frac{Z_3}{Z_4} = \left(R_3 + \frac{1}{j\omega C_3}\right) \frac{1 + j\omega R_4 C_4}{R_4}$

$\Rightarrow \frac{R_1}{R_2} = \frac{R_3}{R_4} + \frac{1}{R_4}\frac{R_4 C_4}{C_3} + j\omega R_3 C_4 + \frac{1}{j\omega C_3 R_4}$ komplex ekv.

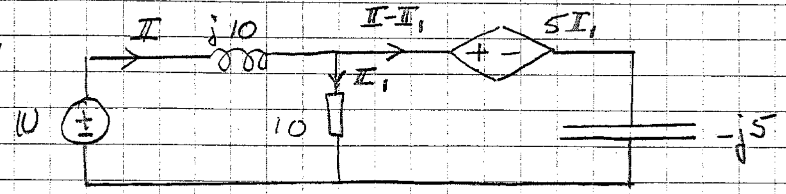
Re: $\frac{R_1}{R_2} = \frac{R_3}{R_4} + \frac{C_4}{C_3}$

Im: $0 = \omega R_3 C_4 - \frac{1}{\omega C_3 R_4}$

$\Rightarrow \omega^2 = \frac{1}{R_3 R_4 C_3 C_4}$ $\omega = \frac{1}{\sqrt{R_3 R_4 C_3 C_4}}$

Lösningar till Elnätverk .. del A för DZ 030821 forts

4/



$I = ?$

$U = U_0 e^{j0°}$

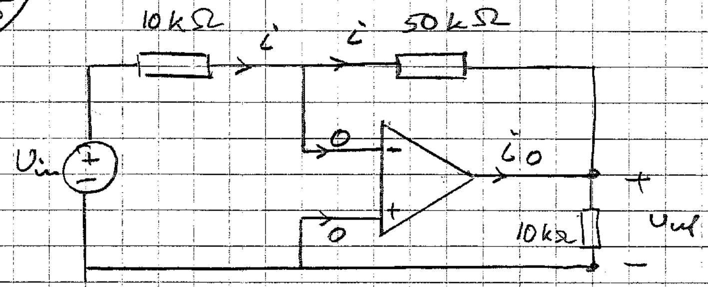
KVL $-U + j10I + 10I_1 = 0$

" $-10I_1 + 5I_1 - j5(I - I_1) = 0$ $\Big\} \Rightarrow I = \frac{U_0}{10}(1-j)$

U levererar $S = \frac{1}{2} U I^* = \frac{1}{2} U_0 \frac{U_0}{10}(1+j) = \underline{\underline{\frac{U_0^2}{20}(1+j)}}$ VA

Medeleffekt $P = Re\{S\} = \underline{\underline{\frac{U_0^2}{20}}}$

5/



a/ KVL $-U_{in} + 10^4 i = 0$

$\Rightarrow i = \frac{U_{in}}{10^4}$

KVL $0 + 5 \cdot 10^4 i + U_{ut} = 0$

$\Rightarrow u_{ut} = -5 U_{in}$

$\underline{\underline{u_{ut}/u_{in} = -5}}$

b/ $u_{in} = 2V \Rightarrow u_{ut} = -5 \cdot 2 = -10V$

$\Rightarrow \underline{\underline{|U_{ut}|}} = 10V < \underline{\underline{u_{mätt}}} = 14V$

$i_0 = ?$ KCL $-i - i_0 + \frac{U_{ut}}{10^4} = 0$

$\Rightarrow i_0 = \frac{u_{ut}}{10^4} - i = \frac{-5 \cdot 2}{10^4} - \frac{2}{10^4} = -1{,}2 \cdot 10^{-3} A$

$\Rightarrow \underline{\underline{|i_0|}} = 1{,}2 \cdot 10^{-3} < \underline{\underline{i_{mätt}}} = 2 \cdot 10^{-3}$ A

$\Rightarrow$ Förstärkaren i linjärt område