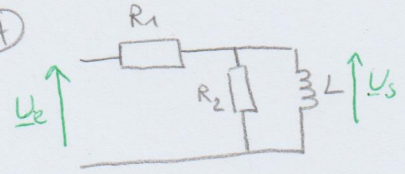
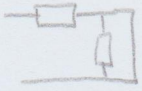
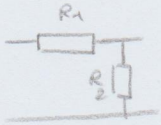
Exercice 4

(A)



Q1 : BF :  HF 

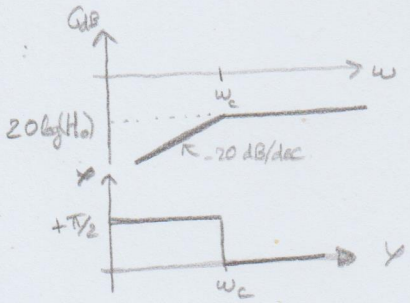
$\frac{U_s}{U_e} = 0$ $\qquad \frac{U_s}{U_e} = \frac{R_2}{R_1+R_2}$

→ filtre passe haut

Q2 : $\underline{H}(j\omega) = \frac{\underline{U_s}}{\underline{U_e}} = \frac{\frac{jL\omega \cdot R_2}{R_2+jL\omega}}{R_1 + \frac{jL\omega \cdot R_2}{R_2+jL\omega}} = \frac{R_2}{R_1+R_2} \times \frac{jL\left(\frac{R_1+R_2}{R_1 R_2}\right)\omega}{1+jL\left(\frac{R_1+R_2}{R_1R_2}\right)\omega}$

$\underline{H}(j\omega) = H_0 \times \frac{j\frac{\omega}{\omega_c}}{1+j\frac{\omega}{\omega_c}}$ avec $\begin{cases} H_0 = \frac{R_2}{R_1+R_2} \\ \omega_c = \left(\frac{R_1R_2}{R_1+R_2}\right)\frac{1}{L} \end{cases}$

Q3 :



Q4 : on cherche $G_c(\omega) = \frac{G_{max}}{\sqrt{2}}$ ou $G_{cdB} = G_{dB_{max}} - 3dB$

$G = H_0 \cdot \frac{\frac{\omega}{\omega_c}}{\sqrt{1+\left(\frac{\omega}{\omega_c}\right)^2}} \rightarrow G_c = \frac{H_0}{\sqrt{2}} \rightarrow \boxed{\omega = \omega_c}$

AN : $\omega_c = 13{,}1$ krad.s^{-1} $\quad f_c = 2{,}09$ kHz

BP = $[\omega_c, +\infty[$

Q5 : $u_e(t) = c^{ste} \Rightarrow \omega \to 0 \Rightarrow \boxed{u_s(t) = 0}$

Q6 : $u_e(t) = U_0 \cdot (1 + \cos(2\pi f_1 \cdot t))$ → on traite chaque composante indépendamment

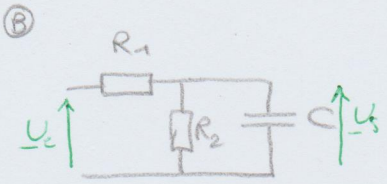
$u_s(t) = 0 + U_0 \times G(f_1) \cdot \cos(2\pi f_1 t + \varphi(f_1))$

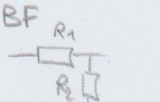
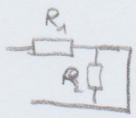
$\rightarrow \boxed{u_s(t) = U_0 \times 37{,}5 \times 10^{-3} \cdot \cos(2\pi f_1 \cdot t + 1{,}47)}$

Q7 : $u_e(t) = U_0 + U_0 \cdot \cos(2\pi f_1 t) + U_0 \cdot \cos(2\pi f_{12} \times 10 t + \frac{\pi}{4}) + U_0 \cos(2\pi f_1 \times 100 t - \frac{\pi}{3})$

$\rightarrow u_s(t) = 0 + 0$ (terme précédent 06 négligeable) $+ U_0 \cdot 0{,}97 \cdot \cos(2\pi f_1 \cdot 10 t + 1{,}93) + U_0 \times 0{,}39 \times \cos(2\pi f_1 \times 100 t - 0{,}91)$

(B)



Q1 : BF  HF 

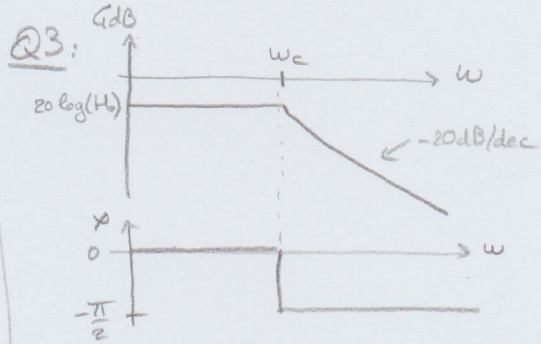
$\frac{U_s}{U_e} = \frac{R_2}{R_1+R_2}$ $\qquad \frac{U_s}{U_e} = 0$

→ filtre passe bas

Q2 : $\underline{H}(j\omega) = \frac{R_2}{R_1+R_2} \times \frac{1}{1+jC\left(\frac{R_1R_2}{R_1+R_2}\right)\omega}$

$= H_0 \times \frac{1}{1+j\frac{\omega}{\omega_c}}$ avec $\begin{cases} H_0 = \frac{R_2}{R_1+R_2} \\ \omega_c = \frac{1}{\left(\frac{R_1R_2}{R_1+R_2}\right).C} \end{cases}$

Q3 :



Q4 : $G_c = \frac{H_0}{\sqrt{2}} \rightarrow \boxed{\omega = \omega_c}$

BP = $[0, \omega_c]$

AN $\omega_c = 12{,}7$ rad.s^{-1} $\quad f_c = 2$ Hz

Q5 : $u_e(t) = c^{ste} \Rightarrow \omega \to 0 \Rightarrow u_s(t) = H_0 \, u_e(t)$
$= 0{,}39 \times u_e(t)$.

Q6 : $u_e(t) = U_0(1 + \cos(2\pi f_1 \cdot t))$

$U_s(t) = U_0 + \underbrace{4\times10^{-3} \cdot U_0 \cdot \cos\left(2\pi f_1 t - \frac{\pi}{2}\right)}_{\text{négligeable}}$

$\boxed{u_s(t) \propto U_0}$

↳ filtre moyenneur

Q7 : pour la même raison

$u_s(t) \simeq U_0$