1.) C 2.) B 3.) A 4.) E 5.) D

II a)

$\omega_0^2 = \omega_{p_1}\omega_{p_2}$ $\quad A_s = 18dB$ $\quad \Omega_s = \dfrac{\omega_{s_1}-\omega_{s_2}}{\omega_{p_1}-\omega_{p_2}} = 12.02$

$A_p = 3dB$ $\quad \omega_{s_1} = 2\pi \times 160$ rad/s

$\omega_{p_1} = 2\pi \times 800$ rad/s $\quad \omega_{s_2} = 2\pi \times 5000$ rad/s $\quad A(1) = 3dB \Leftrightarrow 10\log(1+\varepsilon^2) = 3dB \Rightarrow \varepsilon = 1$ $\quad B = \omega_{p_2}-\omega_{p_1} = 400\times 2\pi$

$\omega_{p_2} = 2\pi \times 1200$ rad/s $\quad \omega_{p_1}\omega_{p_2} = \omega_{s_1}\omega_{s_2}$ Não é uma fórmula $\quad A(12.02) = 18dB \Leftrightarrow 10\log(1+12.02^{2n}) \Rightarrow n = 1$

$\omega_{s_1} = \dfrac{\omega_{p_1}\omega_{p_2}}{\omega_{s_2}} = 192\cdot 2\pi$ //

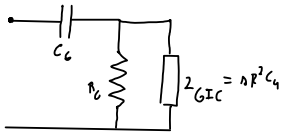
$T(s) = \dfrac{1}{H(s)}\Big|_{s=\frac{s^2+\omega_0^2}{Bs}} = \dfrac{Bs}{s^2+Bs+\omega_0^2} = \dfrac{2513s}{s^2+2513s+37.89\times 10^6}$

b) Para $n=1$ Cheby e Butter são iguais

$A_C(\Omega) = 10\log(1+\varepsilon^2\Omega^2)$

$A_B(\Omega) = 10\log(1+\varepsilon^2\Omega^2)$ //

c) $Y_{GIC} = \dfrac{\frac{1}{R}\cdot\frac{1}{R}\cdot\frac{1}{R}}{sC_4\cdot\frac{1}{R}} = \dfrac{1}{R^2C_4s}$



$\dfrac{R_6 /\!/ sR^2C_4}{R_6 /\!/ sR^2C_4 + \frac{1}{sC_6}} = \dfrac{s^2}{s^2 + \frac{1}{R_6C_6}s + \frac{1}{R^2C_4C_6}}$

$\omega_0^2 = \dfrac{1}{R^2C_4C_6} \Rightarrow C_4 = 3.957$ mF

$\dfrac{\omega_0}{Q} = \dfrac{1}{R_6C_6} \Leftrightarrow R_6 = 14.07\,K\Omega$

d) Tirar de V_2 (Saída do Amp Op 2)

III a) FIR - Estável - $y_m = 2x_m + 0{,}4x_{m-1} + 0{,}8x_{m-2} + 0{,}4x_{m-3} + 2x_{m-4}$

b) $T(e^{j\omega T}) = 2 + 0{,}4e^{-j\omega T} + 0{,}8e^{-j2\omega T} + 0{,}4e^{-j3\omega T} + 2e^{-j4\omega T}$

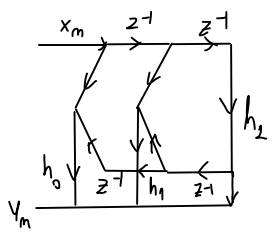
$= e^{-2j\omega T}\left(2e^{2j\omega T} + 2e^{2j\omega T} + 0{,}4e^{j\omega T} + 0{,}4e^{-j\omega T} + 0{,}8\right) =$

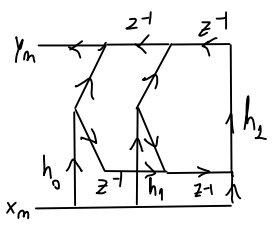
$= e^{-2j\omega T}\left(0{,}8 + 4\cos(2\omega T) + 0{,}8\cos(\omega T)\right)$

$\varphi = -2\omega T$

$\tau = -\dfrac{\partial\varphi}{\partial\omega} = 2T = 40\mu s$ $\quad 0{,}8 + 4 + 0{,}8 = 5{,}6$ em DC

c)





d) $\Delta\gamma = 2\pi(f_2-f_1)T = 0{,}3142$ $\quad \frac{4\pi}{N}$ $\quad \Delta\gamma \approx \frac{4\pi}{N}$ $\quad \Rightarrow N > \frac{4\pi}{\Delta\gamma}$ $\quad N=40 \Rightarrow m > 39$

IV a) Ponte de Wien

$\omega = \frac{1}{RC} = 6.25\,K\,Rad/s$

b) Controlo da amplitude das oscilações

Vem com menos distorção!

c) Não afectam xD

Apenas criam uma componente DC na saída do Amp-op