a) $A_p = 0,5\,dB \qquad A_s = 10\,dB$

$f_p = 2\,kHz \qquad f_s = 5\,kHz \Rightarrow \Omega_p = 1 \qquad \Omega_s = \frac{5}{2}$

$$A_c(\Omega) = 10\log\left(1+\varepsilon^2 C_m^2(\Omega)\right)$$

$$A_c(1) = 10\log(1+\varepsilon^2) = 0,5 \Rightarrow \varepsilon = 0.35$$

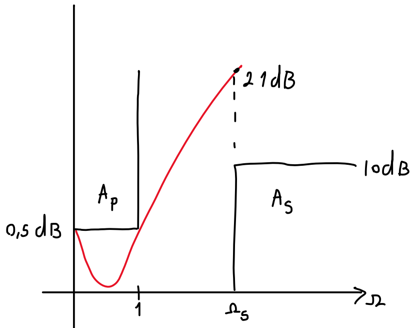
$$A_c\left(\tfrac{5}{2}\right) = 10\log\left(1+c_m^2\left(\tfrac{5}{2}\right)\right) \geq 10\,dB \Rightarrow m=1: \quad 10\log\left(1+\left(\tfrac{5}{2}\right)^2\right) = 8.603\,dB$$

$$m=2: \quad 10\log\left(1+\left(2\left(\tfrac{5}{2}\right)^2-1\right)^2\right) = 21.247\,dB$$

Temos $m=2$.

$$T(\hat{s}) = \left.\frac{K}{\hat{s}^2+1.425\hat{s}+1.516}\right|_{\hat{s}=\frac{s}{\omega_p}} = \frac{K\omega_p^2}{s^2+1.425\omega_p s+1.516\omega_p^2} = \frac{2,26\times10^8}{s^2+1.789\times10^4 s+2.39\times10^8}$$

Logo:



$m=2 \Rightarrow$ 2 extremos na banda passante

b)

$$T(s) = \frac{3.9478\times10^9}{s^2+1.5708\times10^4 s+3.9478\times10^9}$$

$$T_{LP}(s) = \frac{K\omega_0^2}{s^2+\frac{\omega_0}{Q}s+\omega_0^2}$$

$$\begin{cases} K\omega_0^2 = 3.9478\times10^9 \\ \frac{\omega_0}{Q} = 1.5708\times10^4 \\ \omega_0^2 = 3.9478\times10^9 \\ \omega_0 = \frac{1}{RC} \\ \frac{R_3}{R_2} = 2Q-1 \\ K = 2-\frac{1}{Q} \end{cases} \Rightarrow \begin{cases} R = 1K\Omega \\ R_3 = 1K\Omega \\ \omega_0 = 62.831K\,rad/s \Rightarrow f_0 = 10kHz \\ C = 15.91\,mF \approx 16\,mF \\ Q = 4 \\ K = \frac{7}{4} \\ R_2 = 142.86\,\Omega \end{cases}$$