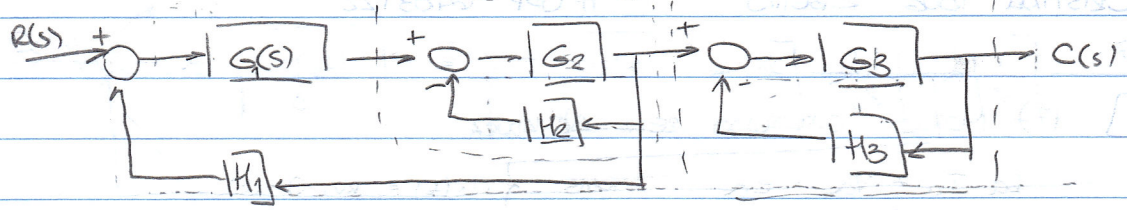
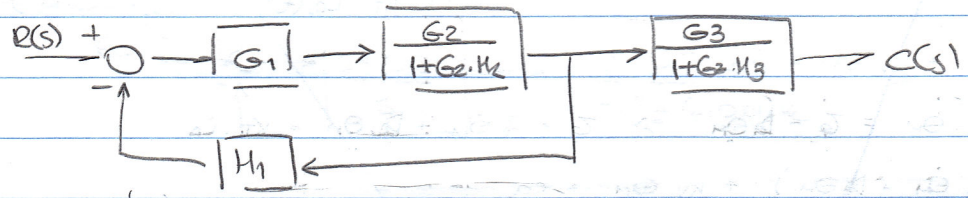
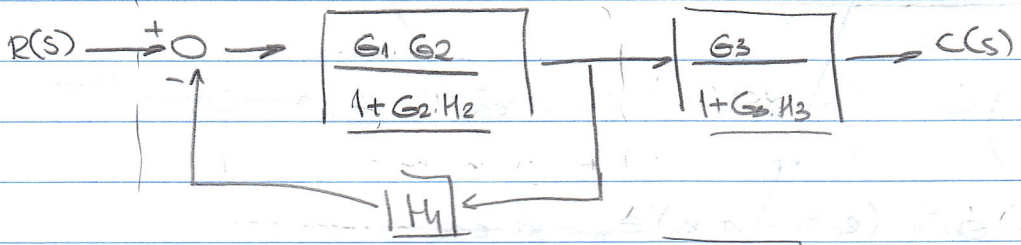
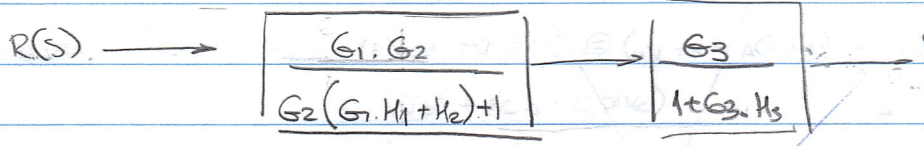
2





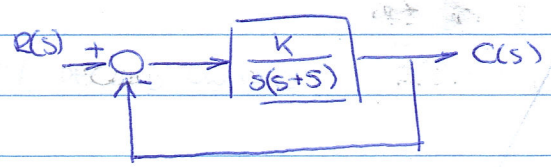




PORTANTO,

$$\frac{C(s)}{R(s)} = \left(\frac{G_1 \cdot G_2}{G_2 (G_1 \cdot H_1 + H_2) + 1}\right)\left(\frac{G_3}{1 + G_3 \cdot H_3}\right)$$

3



(A) $M_p = 10\%$

(DO GRÁFICO $M_p \times \xi$) ; $M_p(\xi) = 10\%$ PARA $\boxed{\xi \simeq 0{,}58}$

$$G(s) = \frac{K}{s(s+5)} = \frac{\omega_n^2}{s(s+2\xi\omega_n)}$$

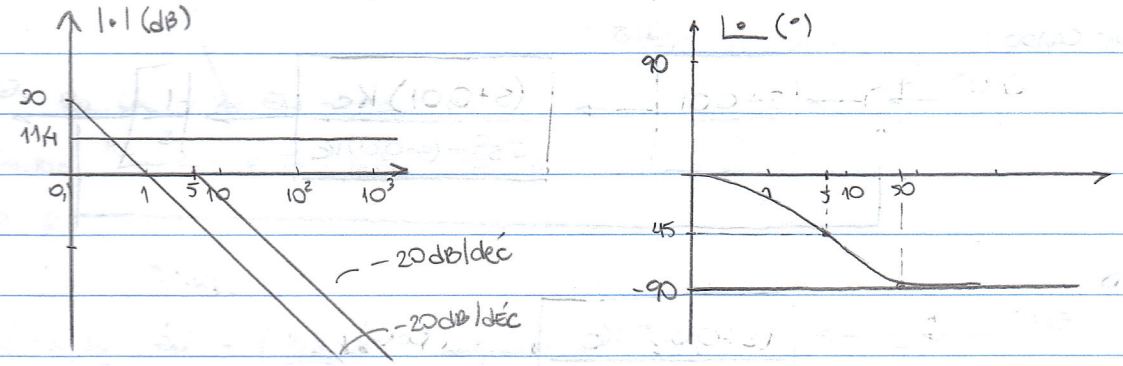
$$\Rightarrow 2\xi\omega_n = 5 \Rightarrow \omega_n = \frac{5}{2\xi} \simeq \frac{5}{2.(0{,}58)} \cong \boxed{4{,}31}$$

ASSIM, $K = \omega_n^2 \cong (4{,}31)^2 \cong \boxed{18{,}58}$

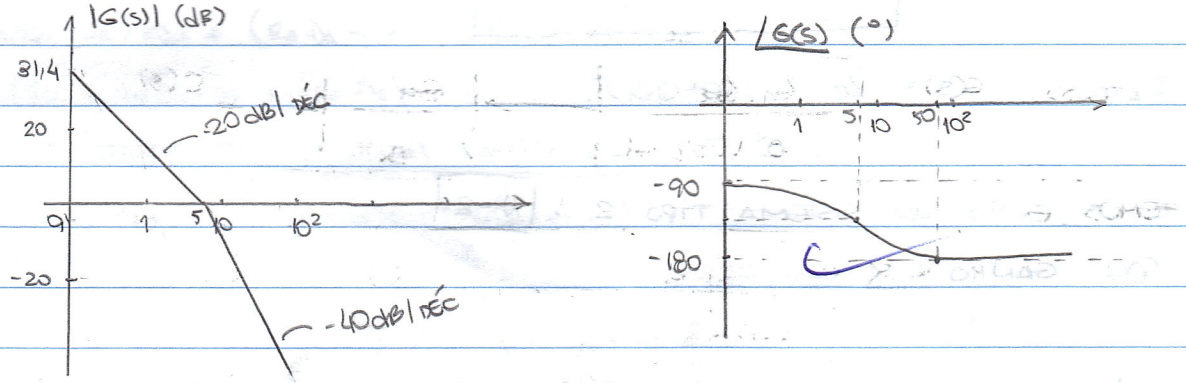
$$\boxed{K = 18{,}58}$$

(b) $G(s) = \frac{18,58}{s(1+s)} = \frac{18,58}{s(\frac{1}{5}+1)\,5} = \frac{3,7}{s(\frac{s}{5}+1)}$ → $20\log 3,7 \cong 11,4$

↳ 3 TERMOS: GANHO, PÓLO NA ORIGEM, PÓLO REAL FORA DA ORIGEM



PORTANTO, AS CURVAS DE BODE DE MALHA ABERTA DO SISTEMA:



(c) TEMOS UM SISTEMA DE TIPO 1 E O ERRO ESTACIONÁRIO DE UM SISTEMA GENÉRICO É DADO POR: $e_{\infty} = \lim_{s\to 0} s \frac{1}{1+\frac{K}{s^N}} \cdot R(s)$

ONDE, NESSE CASO, $N=1$ E $K=3,7$

PARA RAMPA UNITÁRIA: $R(s) = \frac{1}{s^2}$

PORTANTO, $e_{\infty} = \lim_{s\to 0} s \frac{1}{1+\frac{3,7}{s}} \frac{1}{s^2} = \lim_{s\to 0} \frac{s}{s+3,7} \cdot \frac{1}{s}$

$\Rightarrow e_{\infty} = \frac{1}{3,7} = \boxed{0,27}$ //