→ FCD - Ficha 6

3-

$$H(f) = \frac{3,75 \times 10^9}{3,75 \times 10^3 - j9 \times 10^4 + jf} = \frac{1}{(3,75 \times 10^3)} \cdot \frac{1}{1 - \left(\frac{j9 \times 10^4 + jf}{3,75 \times 10^3}\right)}$$

$$= \frac{1}{1 + j\left(\frac{f - 9 \times 10^4}{3,75 \times 10^3}\right)}$$

a)
$$H(f) = \frac{K}{1 + j\left(\frac{f - f_0}{f_0 - f_0}\right)^m}$$

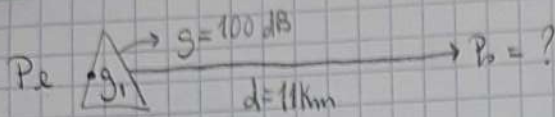$$\frac{①=K}{1 + j\left(\frac{f - \boxed{9 \times 10^4} \to f_0}{3,75 \times 10^3}\right)^{0 \to =m}}$$

- $K = 1 \Rightarrow$ filtro atenuado
- $m = 1 \Rightarrow$ filtro de primeira ordem
- $f_0 = 9 \times 10^4 \, Hz = 90 \, KHz$
- $f_{cs} - f_0 = 3,75 \times 10^3 \Rightarrow f_{cs} = 93,75 \, KHz$
- $f_{ci} = 2 f_0 - f_{cs} = 86,25 \, KHz$
- $B_T = [f_{ci}, f_{cs}] = [86,25 ; 93,75]_+^{KHz}$

$$= 7,5 \, KHz \Rightarrow passa \ banda$$
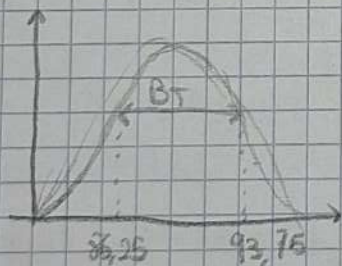
86,25   93,75

- Sistema (filtro) passa-banda de 1ª ordem centrado em 90 KHz. Atenuada (K ≤ 1)
  - Banda de transmissão [86,25 , 93,75] KHz
  - Largura de Banda 7,5 KHz
  - f_{ci} : 86,25
  - f_{cs} : 93,75

4 -

P_e →| g_1 |→ $g = 100 \, dB$ → $P_o = ?$

$d = 11 \, Km$

- Em dBm : $P_{o \, dBm} = P_{e \, dBm} + g_{dB} - L_{dB}$

- Sem ser dBm : $P_o = \dfrac{P_e \times g}{2}$

- Em dBm :

$$P_{e \, dBm} = 10 \log_{10} \frac{P}{1mW} = 10 \log_{10} (10 \times 10^3) = 10 \times 4 = 40 \, dBm$$

$$L_{dB/Km} = 10 \log_{10} 10 = 10 \times 1 = 10$$

$$L_{dB \, 11Km} = L_{dB/Km} \times d = 10 \times 11 = 110 \, dB$$

$$P_{o \, dBm} = 40 + 110 - 110 = 30 \, dBm$$

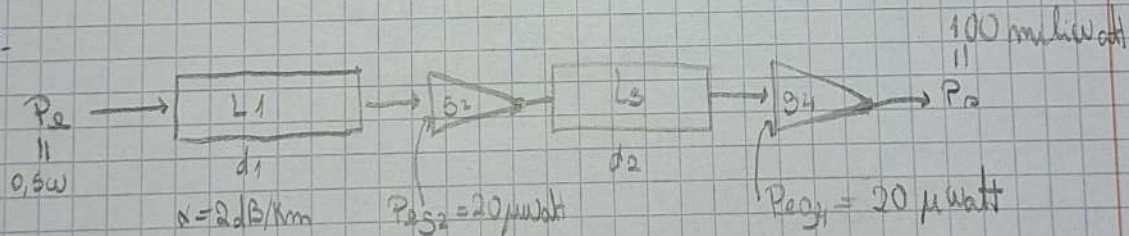$$P_{o \, dBm} = 10 \log_{10} P_o \Rightarrow P_o = 100 \; miliwatt$$
$$= 1 \, watt$$

A 1 - F   C 3 - F

B 2 - F   D 4 - F

6 -

P_e → | L 1 | → | g_2 | → | L_3 | → | g_4 | → P_o

|| d_1 d_2 100 miliwatt

0,5w $\alpha = 2 dB/Km$ $P_e \, g_2 = 20 \mu watt$ $P_e \, g_4 = 20 \, \mu watt$

                                                      $= 20 \times 10^{-3} \; miliwatt$

                                                      $= 0,02 \; miliwatt$

- $P_e = 0,5w$

- $\alpha = 2 dB = 2 \, Km$

- $d = 40 \, Km = d_1 + d_2$

- $P_o = 100 \; mW$

8-

$$H(f) = \frac{1}{25 + j\left(\frac{f - 10 \times 10^3}{10^3}\right)^2} = \frac{\frac{1}{25}}{\frac{25}{25} + j\left(\frac{f - 10^4}{10^3}\right)^2} \Big/ 25 = 5^2$$

$$= \frac{\frac{1}{25}}{1 + j\left(\frac{f - 10^4}{5 \times 10^3}\right)^2}$$

- $K = \frac{1}{25}$
- $m = 2 \Rightarrow 2°\ ordem$
- $f_0 = 10^4 = 10\,KHz$

- $f_{CS} - f_0 = 5 \times 10^3 \Rightarrow f_{CS} = 15\,KHz$
- $f_{Ci} = 2 \times f_0 - f_{CS} = 5\,KHz$

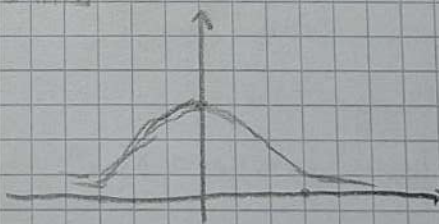- $B = [f_{Ci}, f_{CS}] = [5, 15] = 10\,KHz \Rightarrow$ pasa banda

- A1 – V
- B2 – F
- C3 – V
- D4 – V

7-

$$H(f) = \frac{5}{1 + j\left(\frac{f}{2 \times 10^3}\right)^2}$$

- $K = 5 \Rightarrow$ amplificador
- $m = 2 \Rightarrow 2°\ ordem$
- $f_0 = 0\,KHz$

- $f_{CS} - f_0 = 4 \times 10^3 \Rightarrow f_{CS} = 4\,KHz$
- $f_{Ci} = 2 \times f_0 - f_{CS} = -4\,KHz$

- $B = [f_{Ci}, f_{CS}] = [-4, 4] = 4\,KHz$ • pasa baixo