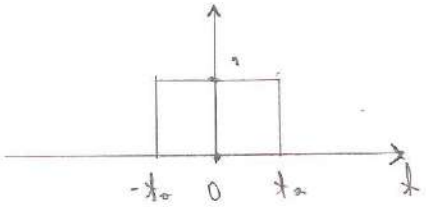
III. LABOS

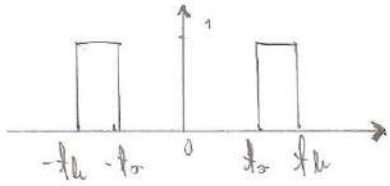
3.1.1 a)



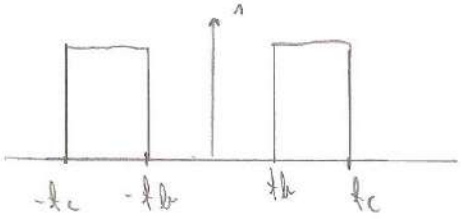
$A_1 = 1 \qquad |f| \leq f_a$

$\frac{f_s}{2} = 22050\,Hz$

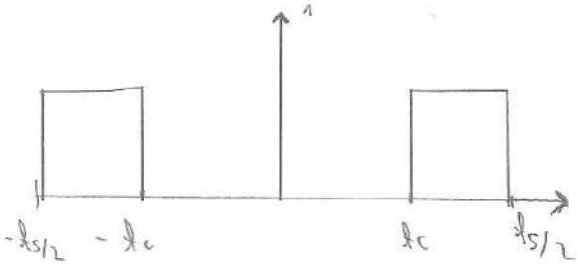
$f_s = 44100\,Hz$



$A_2 = 1 \qquad f_a \leq |f| \leq f_b$



$A_3 = 1 \qquad f_b \leq |f| \leq f_c$



$A_4 = 1 \qquad f_c \leq |f| \leq f_{s/2}$

H_1

$$a[m] = \frac{1}{\pi} \int_{\frac{-2\pi f_a}{44100}}^{\frac{2\pi f_a}{44100}} \cos(\omega m)\, d\omega = \frac{2}{\pi}\,\frac{1}{m}\,\sin(\omega m)\Big|_0^{f_a \cdot \pi/22050} = \frac{2}{\pi m}\sin(\omega_a m)$$

$$a[0] = \frac{\omega_A}{\pi} = \frac{f_a}{22050}$$

H_2

$$a[0] = \frac{1}{2\pi}\left[\int_{-\omega_b}^{\omega_a} d\omega + \int_{\omega_a}^{\omega_b} d\omega\right] = \frac{1}{2\pi}\left[-\omega_a + \omega_b + \omega_b - \omega_a\right] = \frac{\omega_b - \omega_a}{\pi}$$

$$a[m] = \frac{1}{\pi}\left[\int_{-\omega_b}^{-\omega_a} \cos(\omega m)\, d\omega + \int_{\omega_a}^{\omega_b} \cos(m\omega)\, d\omega\right] = \frac{1}{\pi m}\left[\sin(-\omega_a m) - \sin(-\omega_b m)\right.$$

$$\left. + \sin(\omega_b m) - \sin(\omega_a m)\right]$$

$$= \frac{2}{\pi m}\left[\sin(\omega_b m) - \sin(\omega_a m)\right]$$

H_3 $a(0) = \frac{1}{2\pi}\left[\int_{-w_c}^{-w_h} dw + \int_{w_h}^{w_c} dw\right] = \frac{w_c - w_h}{\pi}$

$a[m] = \frac{1}{\pi}\left[\int_{w_c}^{-w_h} \cos(wm)\, dw + \int_{w_h}^{w_c} \cos(wm)\, dw\right]$

$= \frac{2}{\pi m}\left[\sin(w_c m) - \sin(w_h m)\right]$

H_4 $a[0] = \frac{1}{2\pi}\left[\int_{-w_d}^{-w_c} dw + \int_{w_c}^{w_d} dw\right] = \frac{w_d - w_c}{\pi}$

$a[m] = \frac{1}{\pi}\left[\int_{-w_d}^{-w_c} \cos(wm)\, dw + \int_{w_c}^{w_d} \cos(wm)\, dw\right] = \frac{2}{\pi m}\left[\sin(w_d \cdot m) - \sin(w_c \cdot m)\right]$

$H_1(e^{jw}) + H_2(e^{jw}) + H_3(e^{jw}) + H_4(e^{jw}) =$

$a[0]$ ČLANOVI $= \frac{1}{\pi}\left[w_a + w_b - w_b + w_c - w_a + w_d - w_c\right] = \frac{1}{\pi} \cdot w_d = \frac{w_d}{\pi}$

$w_d = \pi \Rightarrow a_{UK}[0] = 1$

$\int_{-\pi}^{\pi} \cos(2w)\, dw = 0$ .. OSTAJE SAMO $\frac{w_d}{\pi} = 1$

DODAMO KAŠNJENJE $e^{-\frac{N}{2}jw}$ JER RADIMO S KAUZALNIM SIGNALIMA

$H_1(e^{jw}) + H_2(e^{jw}) + H_3(e^{jw}) + H_4(e^{jw}) = e^{-\frac{N}{2}jw}$