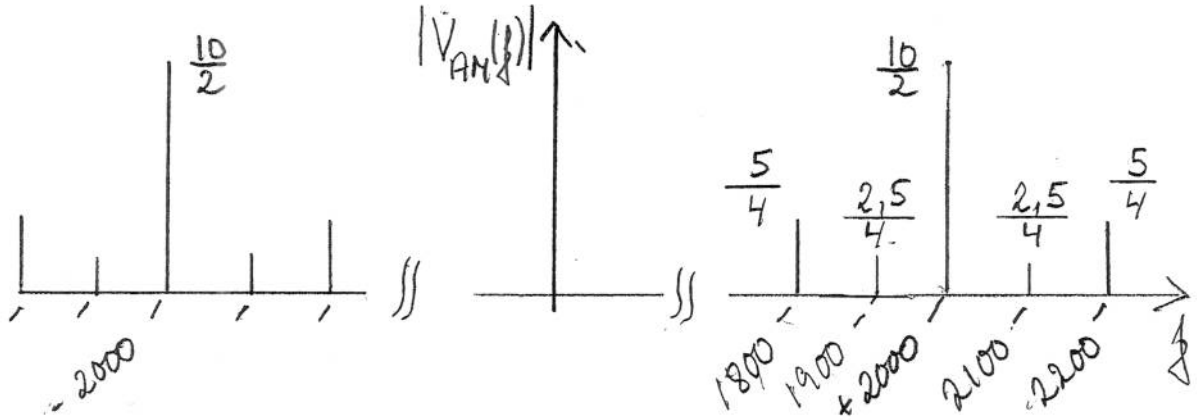
EXAM : INTRODUCTION TO WIRELESS COMMUNICATION

PROBLEM 1 :

a) $v_{AM}(t) = A_c [1 + k_a \cdot v(t)] \cdot \cos(2\pi f_c t)$

$= 10 [1 + 0,5(0,5 \cdot \cos(200\pi t) + \cos(400\pi t)] \cdot \cos(2\pi \cdot 2 \cdot 10^3 t)$

$= 10 [1 + 0,25 \cos(2\pi \cdot 100 t) + 0,5 \cdot \cos(2\pi 200 t)] \cdot \cos(2\pi \cdot 2 \cdot 10^3$

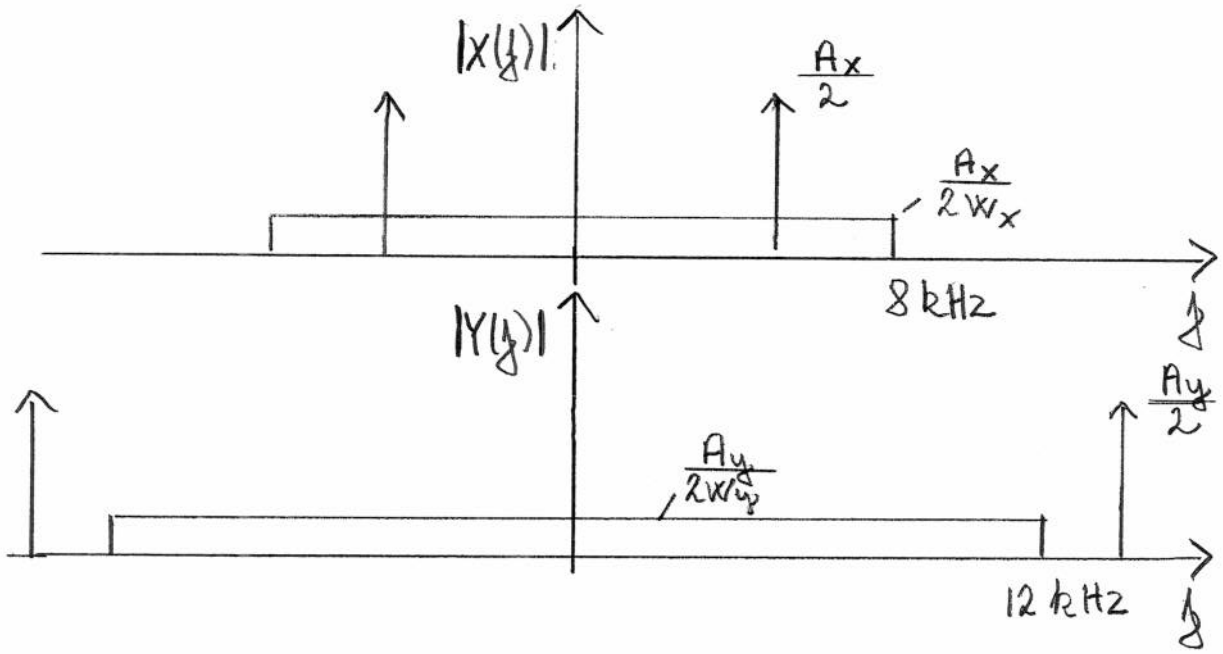


b) $v_{dsb-sc}(t) = A_c \cdot v(t) \cdot \cos(2\pi \cdot f_c \cdot t)$

$= 10 \cdot (0,5 \cdot \cos(2\pi \cdot 100 t) + \cos(2\pi \cdot 200 t)) \cdot \cos(2\pi \cdot 2 \cdot 10^3 t)$

c) . . . .

PROBLEM 2:



The Nyquist sampling rates:

a) $x(t)$: 16 kHz ^ $y(t)$: 28 kHz

b) $x^2(t)$: 32 kHz ^ $y^2(t)$: 56 kHz

c) $x(t) \cdot y(t)$: 44 kHz

(b and c solved by convolution in the frequency-domain)

PROBLEM 3:

For $\beta = 2$ $\left(= \frac{\Delta f}{f_m}\right.$, wideband FM) we have:

$J_0(2) \sim 0,27$

$J_1(2) \sim 0,57$

$J_2(2) \sim 0,36$

$J_3(2) \sim 0,15$

$(J_4(2) \sim 0,03)$

The output of the bandpass filter with the bandwidth $7 \cdot f_m$ is approximately (J-values):

$$\begin{aligned} s_0(t) = {} & 0,27 \cos(2\pi f_c t) \\ & + 0,57 \left(\cos(2\pi \cdot (f_c + f_m)t) + \cos(2\pi (f_c - f_m)t)\right) \\ & + 0,36 \left(\cos(2\pi \cdot (f_c + 2f_m)t) + \cos(2\pi (f_c - 2f_m)t)\right) \\ & + 0,15 \left(\cos(2\pi \cdot (f_c + 3f_m)t) + \cos(2\pi (f_c - 3f_m)t)\right) \end{aligned}$$

The magnitude spectrum of $s_0(t)$ for positive frequencies: