(B) Many terms in (3) are zero as we show below.

We will use the parseval's theorem, which states that for any signals $x(t)$ and $y(t)$ for which the Fourier transforms ~~exists~~ $X(f)$ and $Y(f)$ exists,

it is true that

$$\int_{-\infty}^{+\infty} x(t)\, y^*(t)\, dt = \int_{-\infty}^{+\infty} X(f)\, Y^*(f)\, df .$$

In (3), we will show that the term

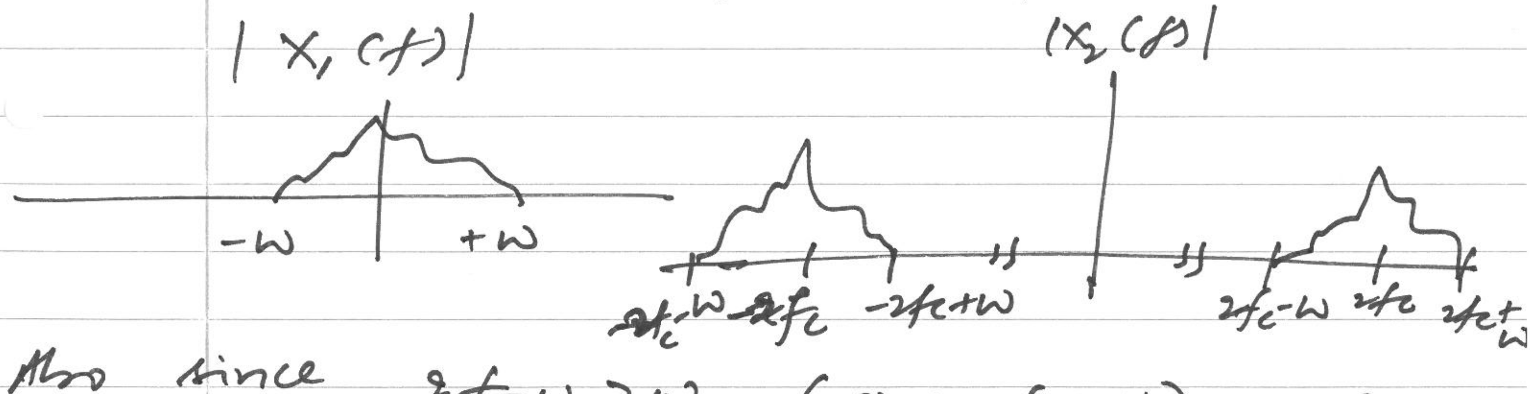
$$\frac{1}{2}\int h^I(\tau)\, x^I(t-\tau) \cos 2\pi f_c (2\tau - t)\, d\tau = 0.$$

let $\cancel{x_1(t)} \; x_1(\tau) \triangleq h^I(\tau)$ and

$$x_2(\tau) \triangleq x^I(t-\tau) \cos 2\pi f_c [2\tau - t]$$

Note that these are function of τ for a fixed t.

We immediately see that $x_1(\tau)$ is baseband and $x_2(\tau)$ is passband.



Also since $2f_c - W > W$ (since $f_c > W$), we have the product $X_1(f)\, X_2(f) = 0$ everywhere.

From parseval's theorem