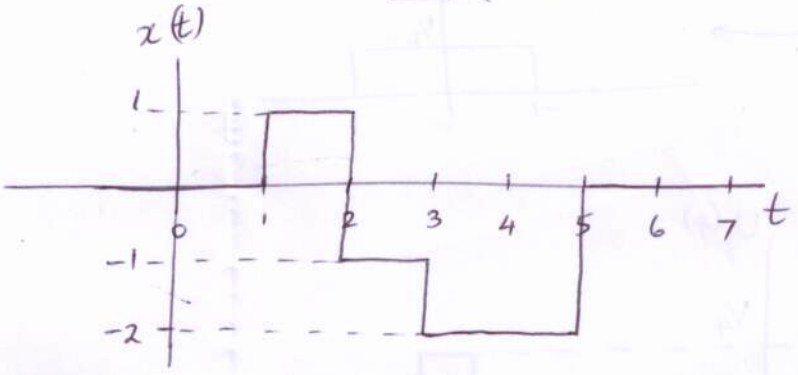
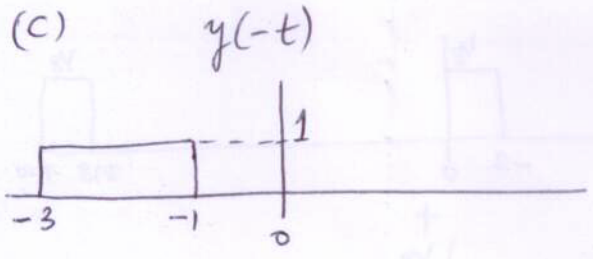
Q1 (2016)

1) (a)

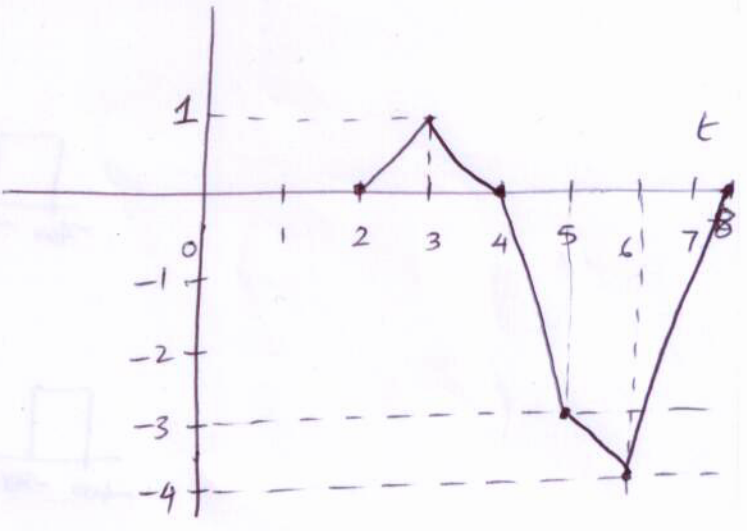


(b) Energy of $x(t) = \int_{-\infty}^{\infty} x^2(t)\,dt = 1 + 1 + 4(2) = \underline{10}$.

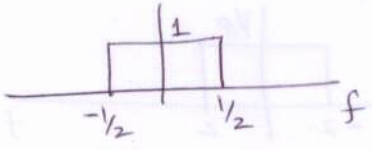
(c)



Convolution of $y(t)$ & $x(t)$

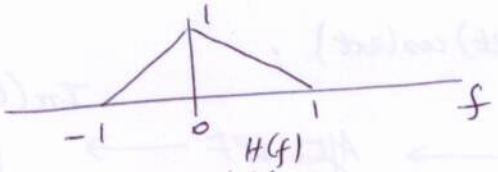


2) (a) $\text{sinc}(t) \longleftrightarrow$

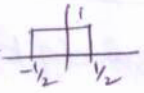


$T\,\text{sinc}(Tf) \longleftrightarrow I_{[-\frac{T}{2},\frac{T}{2}]}(f)$

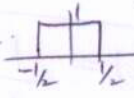
$\text{sinc}^2(t) \longleftrightarrow$



(convolution of

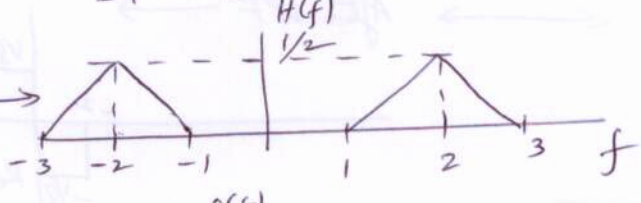


&

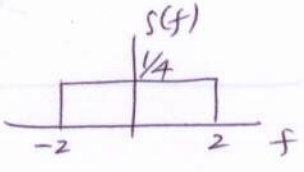


)

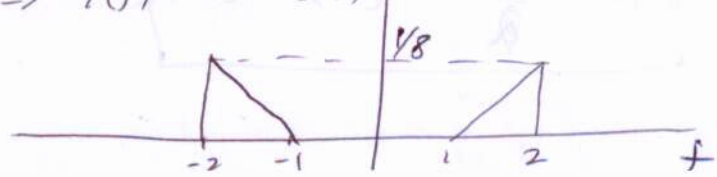
$h(t) \longleftrightarrow$



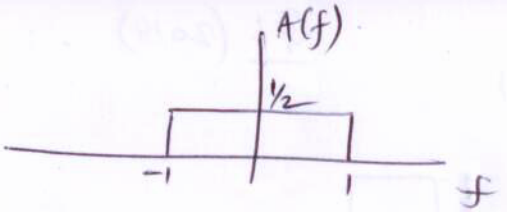
(b) $\text{sinc}(4t) \longleftrightarrow$



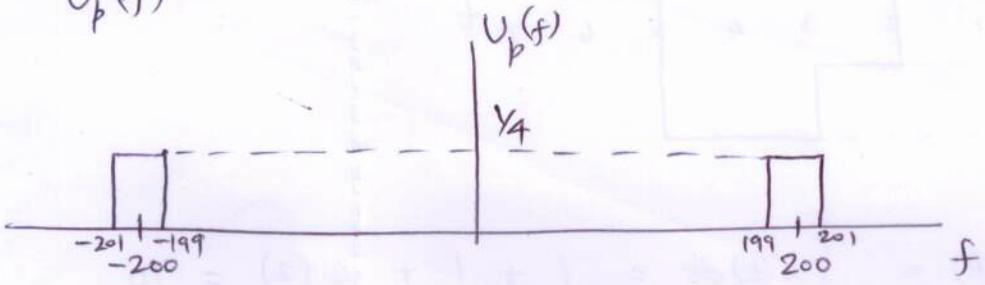
$\Rightarrow Y(f) = H(f)S(f)$



3) (a) $a(t) = \text{sinc}(2t) \longleftrightarrow$

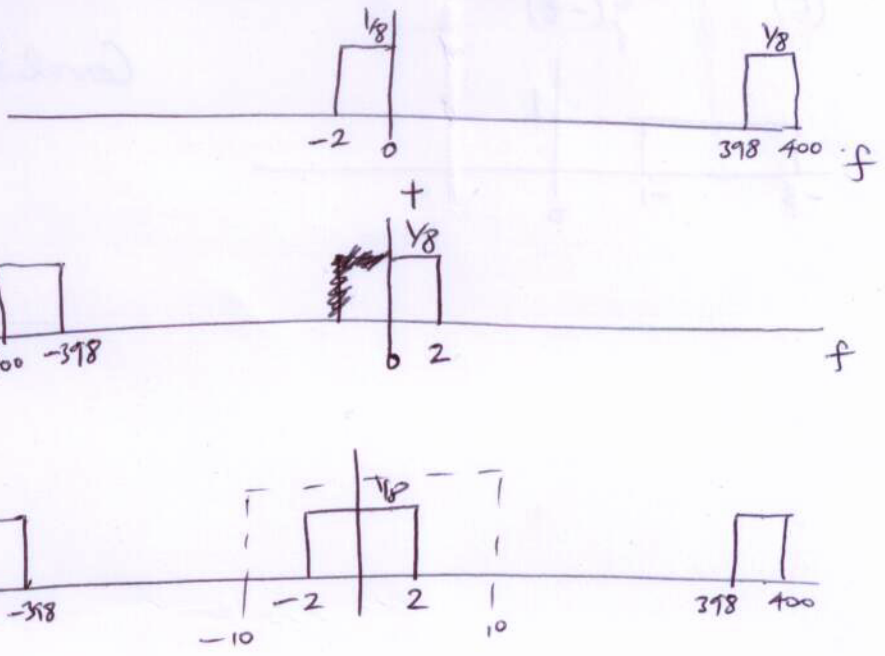


$U_p(f)$

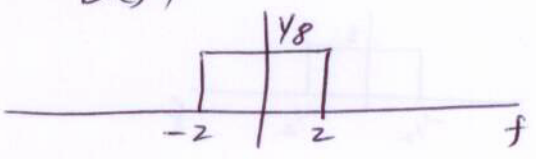


Frequency band occupied by $u_p(t)$ 199 to 201 Hz.

(b) $u_p(t)\cos(398\pi t) \longleftrightarrow$



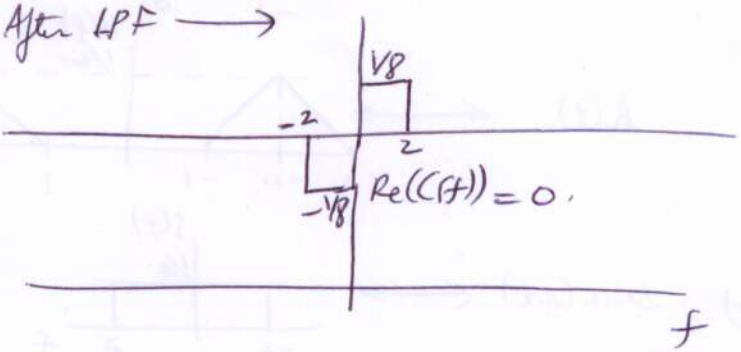
$b(t) \longleftrightarrow B(f)$



$= \frac{1}{8}(4\,\text{sinc}(4t)) \longleftrightarrow$

$\boxed{b(t) = \frac{1}{2}\text{sinc}(4t)} = \frac{1}{2}\text{sinc}(2t)\cos(2\pi t).$

(c) $u_p(t)\sin(398\pi t) \longleftrightarrow$ After LPF $\longrightarrow$ $Im(C(f))$



$\boxed{c(t) = -\frac{1}{2}\text{sinc}(2t)\sin(2\pi t)} \longleftrightarrow$