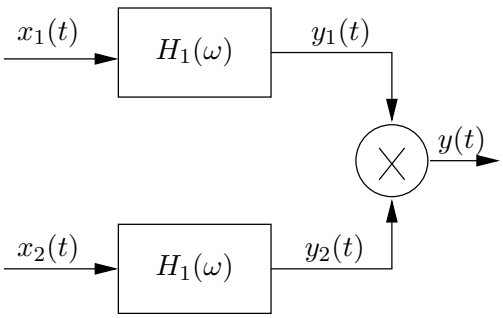
EC204: Networks & Systems
Problem Set 5

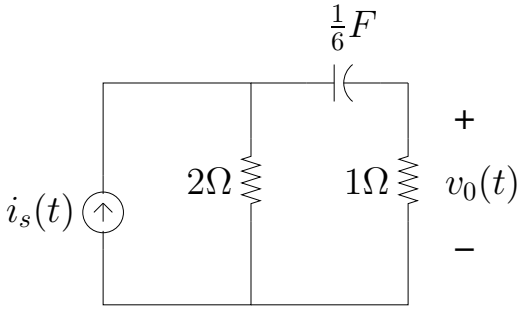
1. $x_1(t) = 10^4\, rect(10^4 t)$ and $x_2(t) = \delta(t)$ are applied as inputs to LTI systems with frequency responses $H_1(\omega) = rect(\omega/40000\pi)$ and $H_2(\omega) = rect(\omega/20000\pi)$.

   (a) Sketch $Y_1(\omega)$ and $Y_2(\omega)$.

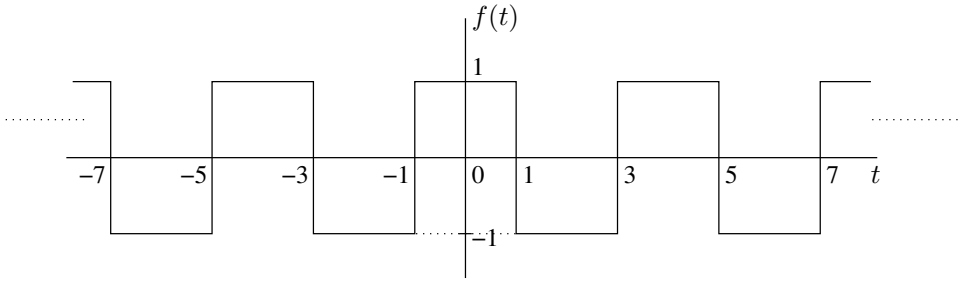
   (b) Find the bandwidth (in Hz) of $y(t)$.



2. Consider the circuit shown below to be an LTI system with input $i_s(t)$ and output $v_0(t)$. Assume that the capacitor is initially uncharged. Using Fourier transforms, find the response to the input $i_s(t) = u(t)$ and sketch it.



3. The input to an LTI system is $x(t) = f(t) + 2\cos \pi t$ where $f(t)$ is shown below. The desired output corresponding to this input is $y(t) = \cos \pi t$. Design a frequency response for the LTI system that will lead to the desired output $y(t)$. Sketch the magnitude frequency response of the proposed LTI system.



4. $x(t)$ and $y(t)$ have Fourier transforms as shown below. Sketch the Fourier transform of the various signals $z_i(t)$ for $i = 1, 2, 3, 4$ in the system shown below given that $z_1(t) = x(t)\cos(\omega_1 t) + y(t)\cos(\omega_2 t)$. Determine $z_4(t)$ in terms of $x(t)$ and $y(t)$? Assume that $\omega_1 = \omega_2 - 2W = 5W$.