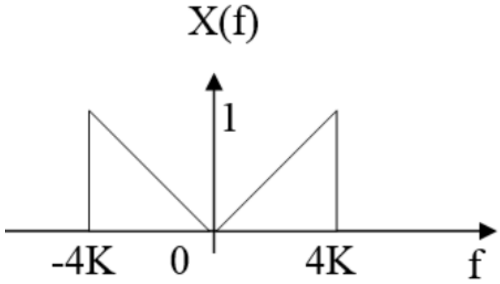
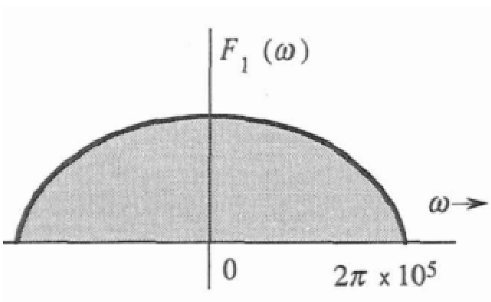
Sheet 7

1. A signal with a spectrum shown in the figure is ideally sampled. Sketch the spectrum of the sampled signal when f_s = 4KHz, can x(t) be recovered ? If so, how? Repeat with f s = 8 KHz and f_s = 10 KHz. Comment on your results.

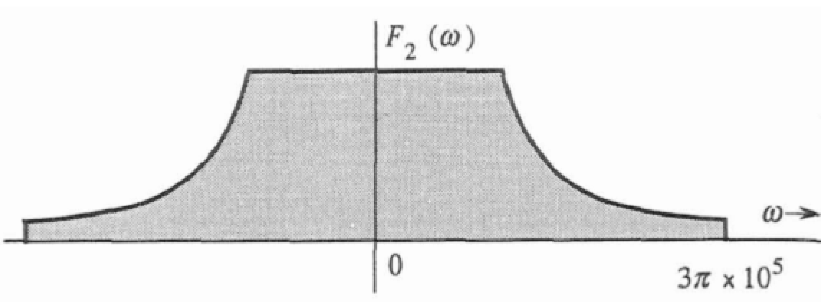


2. Fig. (a) And (b) shows Fourier spectra of signals $f_1(t)$ and $f_2(t)$. Determine the Nyquist sampling rates for the following signals.
   a. $f_1(t)$
   b. $f_2(t)$
   c. $f_1(t).\ f_2(t)$
   d. $(f_1(t))^2$
   e. $(f_1(t))^3$

   (Hint: Use the frequency convolution and the width property of the convolution.)



(a)



(b)

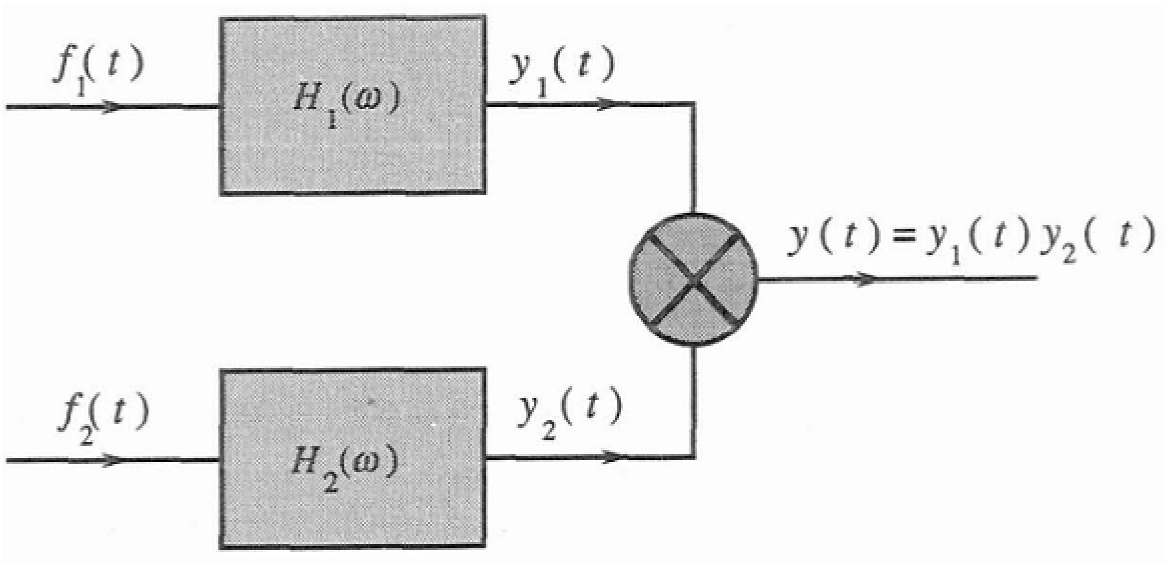
3. Signals $f_1(t) = 10^4 rect(10^4 t)$ and $f_2(t) = \delta(t)$ are applied at the inputs of ideal lowpass filters $H_1(\omega) = rect(\frac{\omega}{40,000\pi})$ and $H_2(\omega) = rect(\frac{\omega}{20,000\pi})$. The outputs $y_1(t)$ and $y_2(t)$ of these filters are multiplied to obtain the signal $y(t) = y_1(t) y_2(t)$ as shown in Figure Q3.

   a) Sketch $F_1(\omega)$ and $F_2(\omega)$.

   b) Sketch $H_1(\omega)$ and $H_2(\omega)$.

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

   d) Find the Nyquist sampling rate of $y_1(t)$, $y_2(t)$ and $y(t)$.



Good Luck