$X(e^{j\omega})$
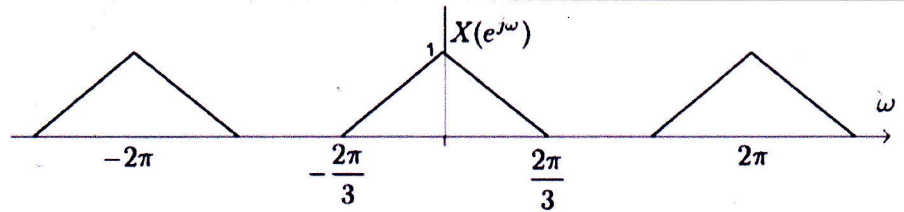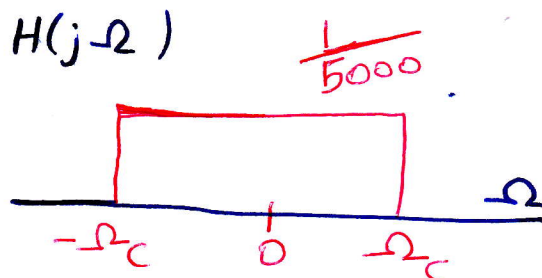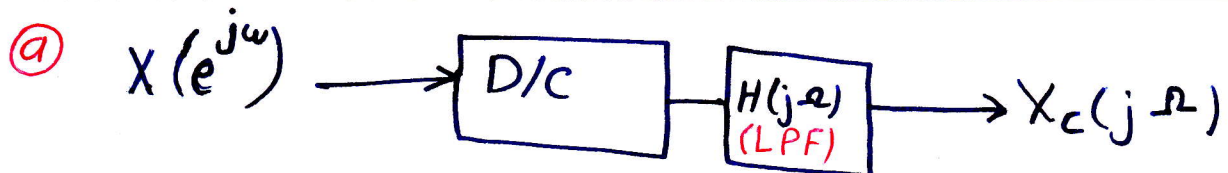

Your friend Rayyan recorded samples of a signal at 5000 samples/sec and gave it to you in a file (x[n]). You wanted to convert it back to a CT signal but before that you decided to analyze the DTFT of that signal, which turned out to be as shown above.
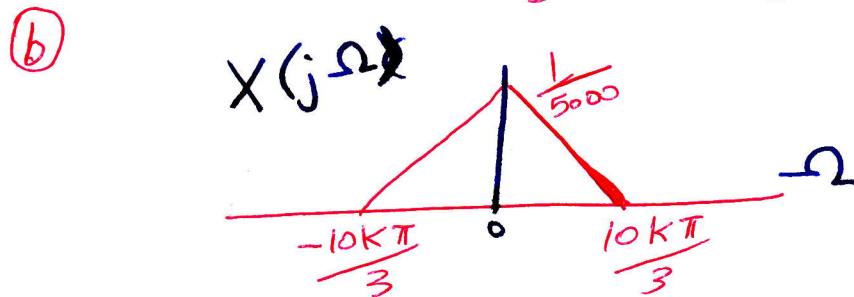
(a) Sketch the block diagram of the reconstruction system that would convert $x[n]$ to $x_c(t)$. Show the specification of any filters/components that you need to use (for filters, sketch the frequency response of the required filters and show the possible range of the cutoff frequency)

(b) Sketch the CTFT $X_c(j\Omega)$ of the reconstructed continuous-time signal.

(c) Do you think that Rayyan's original choice of the sampling rate was good? Explain. If there is a better choice state it and explain its "real" benefit compared to Rayyan's choice.

(a) $X(e^{j\omega})$ ⟶ [D/C] ⟶ [H(jΩ) (LPF)] ⟶ $X_c(j\Omega)$

$H(j\Omega)$

$\dfrac{1}{5000}$

$-\Omega_c \quad 0 \quad \Omega_c$

, $\boxed{\Omega_m < \Omega_c < (\Omega_T - \Omega_m)}$

to find $\Omega_m, \Omega_c, \Omega_T$ → $\boxed{\Omega = \dfrac{\omega}{T}}$

hence, → $\dfrac{10k\pi}{3} < \Omega_c < \dfrac{20k\pi}{3}$

(b) $X(j\Omega)$

$\dfrac{1}{5000}$

$-\dfrac{10k\pi}{3} \quad 0 \quad \dfrac{10k\pi}{3}$

(c) Review Dr. Saeed site.