EE2023 Signals and Systems Mid-term Quiz – AY2018/2019 Semester 1

Q1(a) $X(f) = \dfrac{6}{9 + 4\pi^2 f^2}$

Q1(b) $x_p(t) = x(t) \otimes \sum_{k=-\infty}^{\infty} \delta(t - 3k) = \sum_{k=-\infty}^{\infty} x(t - 3k)$

Q1(c) $X_p(f) = \sum_{k=-\infty}^{\infty} \dfrac{18}{81 + 4\pi^2 k^2} \delta\left(f - \dfrac{k}{3}\right)$

Q1(d) $c_k = \dfrac{18}{81 + 4\pi^2 k^2}$

Q2(a)i $X(f) = 2\cos\left(\dfrac{\pi f}{2}\right).\text{rect}\left(\dfrac{f}{2}\right)$

Q2(a)ii Nyquist rate = 2 Hz

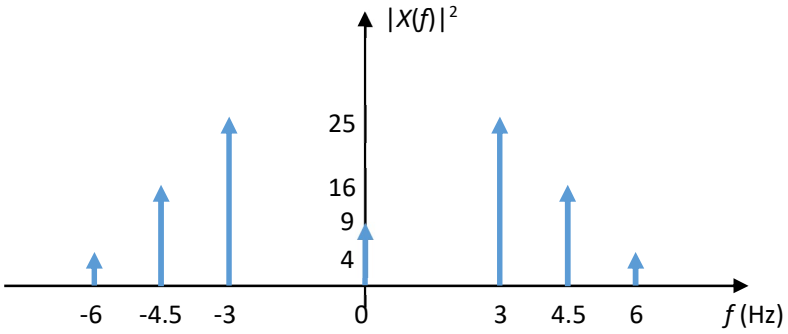
Q2(b)i $x_s(t) = x(t).\sum_{k=-\infty}^{\infty} \delta\left(t - \dfrac{k}{4}\right) = \sum_{k=-\infty}^{\infty} x\left(\dfrac{k}{4}\right)\delta\left(t - \dfrac{k}{4}\right)$

Q2(b)ii $X_s(f) = 8\sum_{k=-\infty}^{\infty} \cos\left(\dfrac{\pi(f - 4k)}{2}\right).\text{rect}\left(\dfrac{(f - 4k)}{2}\right)$

Q3(a) $f_p = 1.5$ Hz

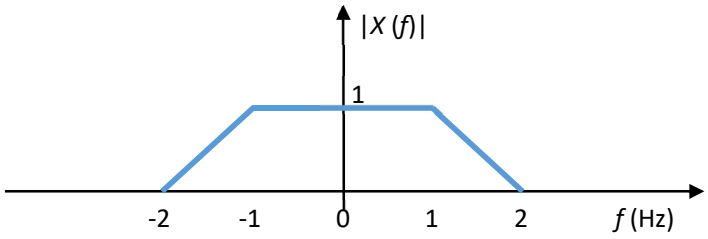
$$c_{-4} = 2e^{j\pi/3} \quad ; c_{-3} = 4e^{j\pi/4} \quad ; c_{-2} = 5e^{j\pi/6} \quad ; c_0 = 3 \quad ; c_2 = 5e^{-j\pi/6} \quad ; c_3 = 4e^{-j\pi/4} \quad ; c_4 = 2e^{-j\pi/3}$$

Q3(b)



Q3(c) DC value = 3 ; $P = 99$

Q4(a) $X(f) = 2\,\mathrm{tri}\left(\frac{f}{2}\right) - \mathrm{tri}(f)$



Q4(b) $f_{3dB} = 2 - \frac{1}{\sqrt{2}} = 1.29$ Hz

Q4(c) $\int_{-\infty}^{\infty} x(t)dt = 1$