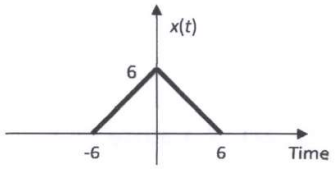
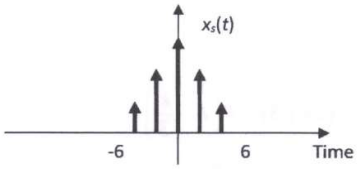
EE2023 Signals and Systems Mid-term Quiz – AY2017/2018 Semester 1

Q1(a)



Q1(b) $x_s(t) = x(t).\sum_k \delta(t-2k)$

Q1(c)



Q1(d) The correct answer: $X_s(f) = 6 + 8\cos(4\pi f) + 4\cos(8\pi f)$

Alternate, but incorrect answer: $X_s(f) = 18\sum_k \text{sinc}^2\left[6\left(f - \frac{k}{2}\right)\right]$

Q1(e) The original signal cannot be recovered.

Q2(a) $x_p(t) = x(t) \otimes \sum_k \delta(t-3k)$

Q2(b) $X(f) = \frac{j}{\pi f}\left[e^{-j2\pi f} - \text{sinc}(2f)\right]$

Q2(c) $X_p(f) = \sum_k \left\{\frac{j}{\pi k}\left[e^{-j2\pi k/3} - \text{sinc}(2k/3)\right]\right\}\delta\left(f - \frac{k}{3}\right)$

Q3(a) Fundamental frequency = 2 rads/s

Q3(b) Fourier series coeficients: $c_{\pm 1} = -0.5$; $c_{\pm 3} = -\sqrt{26}e^{-j1.337}$

Q3(c) No. The figure has the x-axis in Hz and not in rads/s.

Q4(a) Phase spectrum: $\angle X(f) = \begin{cases} \pi/2 & , \quad f > 0 \\ 0 & , \quad f = 0 \\ -\pi/2 & , \quad f < 0 \end{cases}$

Energy spectral density: $E_x(f) = f^2 e^{-|f|^3/125}$

Q4(b) $B \geq 7.483$