

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

Q1(a) Periodic as there is HCF of 1 and  $f_0 = 1$  ;  $T_0 = 1$

Q1(b) No, as amplitude spectrum is even.

Q1(c)  $X(f) = 1e^{j10\pi t} + 2e^{j4\pi t} + 3 + 2e^{j4\pi t} + 1e^{j10\pi t}$   
 $c_0 = 3$  ;  $c_2 = c_{-2} = 2$  ;  $c_5 = c_{-5} = 1$

Q1(d)  $X(f) = 3\delta(f) + 2\delta(f-2) + 2\delta(f+2) + \delta(f-5) + \delta(f+5)$

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Q2(a)  $X(f) = \frac{1}{4} \left[ \text{sinc}\left(\frac{f-2}{4}\right) + \text{sinc}\left(\frac{f+2}{4}\right) \right] \cos\left(\frac{\pi f}{4}\right)$

Q2(b)i  $x_p(t) = x(t) \otimes \sum_{k=-\infty}^{\infty} \delta(t - 0.75k)$

Q2(b)ii  $X_p(f) = \sum_{k=-\infty}^{\infty} \frac{1}{3} \left[ \text{sinc}\left(\frac{4k/3 - 2}{4}\right) + \text{sinc}\left(\frac{4k/3 + 2}{4}\right) \right] \cos\left(\frac{\pi k}{3}\right) \delta\left(f - \frac{4}{3}k\right)$

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Q3(a)  $x(t) = 2\text{sinc}^2(t)$

Q3(b) Energy = 8/3

Q3(c) Correct answer is:  $y(t) = 1 + 0.6\cos(0.8\pi t) + 0.4\cos(1.6\pi t)$

Alternate, not preferred answer:  $y(t) = 5 \sum_{k=-\infty}^{\infty} 2\text{sinc}^2\left(t - \frac{5}{2}k\right)$

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Q4(a) Magnitude spectrum:  $|Y(f)| = 128\text{sinc}^2(4f)$   
Phase spectrum:  $\angle Y(f) = -12\pi f$

Q4(b) Maximum occurs at  $t = 6$  seconds