Name: _____

Student ID: _____

Signature: _____

CITY UNIVERSITY OF HONG KONG

Semester A 2015/2016

EE3210: Signals and Systems

Quiz 8

1. Time allowed: 15 minutes
2. Total number of problems: 2
3. Total marks available: 11
4. This paper may not be retained by candidates

Special Instructions

5. This is a closed book exam
6. Attempt all questions from each problem
7. A list of possibly relevant equations is attached at the end of this paper

Problem 1: (5 marks)

Consider two discrete-time signals $x[n]$ and $y[n]$ that are both periodic with period $N = 3$, and consider

$$x[n] \leftrightarrow a_k = \begin{cases} 1, & k = 0 \\ 1, & k = 1 \\ 0, & k = 2 \end{cases}$$

and

$$y[n] \leftrightarrow b_k = \begin{cases} 0, & k = 0 \\ 1, & k = 1 \\ 0, & k = 2 \end{cases}$$

Determine the Fourier series coefficients c_k of the signal $z[n] = x[n]y[n]$ for $k = 0, 1, 2$.

Problem 2: (6 marks)

(a) (3 marks) Compute the Fourier transform of the continuous-time signal $x(t) = \delta(t-1)$.

(b) (3 marks) Determine the continuous-time signal corresponding to the Fourier transform $X(\omega) = \delta(\omega - 1) + \delta(\omega + 1)$.

Appendix – A list of possibly relevant equations

- Discrete-time Fourier series:
  - Formulas: Consider $x[n]$ periodic with fundamental period $N_0 = N$.
    - Synthesis: $x[n] = \sum_{k=\langle N \rangle} a_k e^{jk\Omega_0 n} = \sum_{k=\langle N \rangle} a_k e^{jk(2\pi/N)n}$
    - Analysis: $a_k = \frac{1}{N} \sum_{n=\langle N \rangle} x[n] e^{-jk\Omega_0 n} = \frac{1}{N} \sum_{n=\langle N \rangle} x[n] e^{-jk(2\pi/N)n}$
  - Properties: Consider $x[n]$ and $y[n]$ periodic with period N, $x[n] \leftrightarrow a_k$, $y[n] \leftrightarrow b_k$.
    - Linearity: $Ax[n] + By[n] \leftrightarrow Aa_k + Bb_k$
    - Time shift: $x[n - n_0] \leftrightarrow \left[e^{-jk(2\pi/N)n_0}\right] a_k$
    - Time reversal: $x[-n] \leftrightarrow a_{-k}$
    - Multiplication: $x[n]y[n] \leftrightarrow \sum_{l=\langle N \rangle} a_l b_{k-l}$

- Continuous-time Fourier transform:
  - Formulas:
    - Analysis: $X(\omega) = \int_{-\infty}^{+\infty} x(t) e^{-j\omega t} dt$
    - Synthesis: $x(t) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} X(\omega) e^{j\omega t} d\omega$

— End of Paper —