Department of Electrical Engineering
School of Science and Engineering

EE310 Signals and Systems

TUTORIAL 5

Tutorial 5-1

Determine the discrete-time periodic signal $x[n]$ of period 8 whose Fourier series coefficients a_k are given by

$$a_k \begin{cases} \cos(\frac{k\pi}{3}), & 0 \leq k \leq 6, \\ 0, & k = 7. \end{cases}$$

Tutorial 5-2

Consider the following two discrete time periodic signals, each with fundamental period 6:

$$x[n] = \cos(\frac{2\pi}{6}n + pi/2), \quad y[n] = 1 - \sin(\frac{2\pi}{6}n).$$

Determine the Fourier series coefficients of the signal $z[n] = x[n]y[n]$.

Tutorial 5-3

Consider a continuous-time LTI system with impulse response

$$h(t) = e^{-2|t|}$$

and input signal (continuous-time and periodic)

$$x(t) = \sum_{n=\infty}^{\infty} (-1)^n \delta(t-n).$$

Determine the Fourier series coefficients of the output of LTI system.

Tutorial 5-4

(Analogous to previous question)Consider a discrete-time LTI system with impulse response

$$h[n] = \frac{1}{2}^n$$

and input signal (continuous-time and periodic)

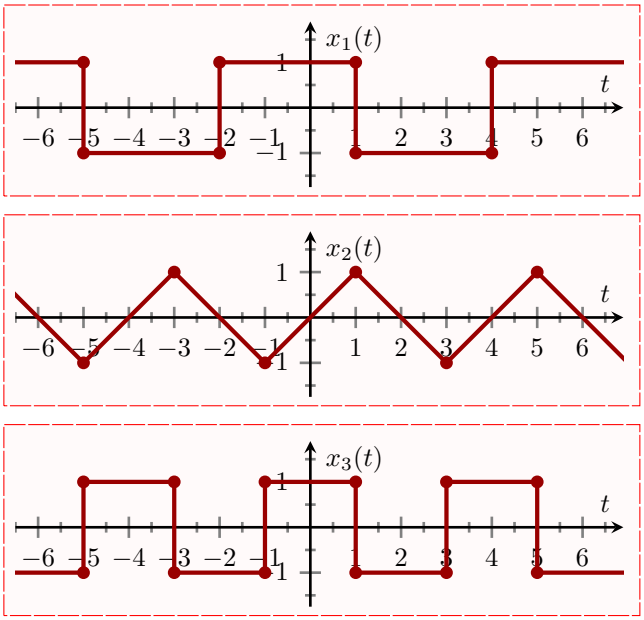
$$x[n] = \begin{cases} 1, & |n| \leq 1, \\ 0, & 2 \leq |n| \leq 3. \end{cases}$$

Determine the Fourier series coefficients of the output of LTI system.

Tutorial 5-5

Without evaluating the Fourier series coefficients, find which of the following periodic signals have Fourier coefficients with the following properties:

1. Only odd harmonics
2. Only real harmonics
3. Only imaginary harmonics



Tutorial 5-6

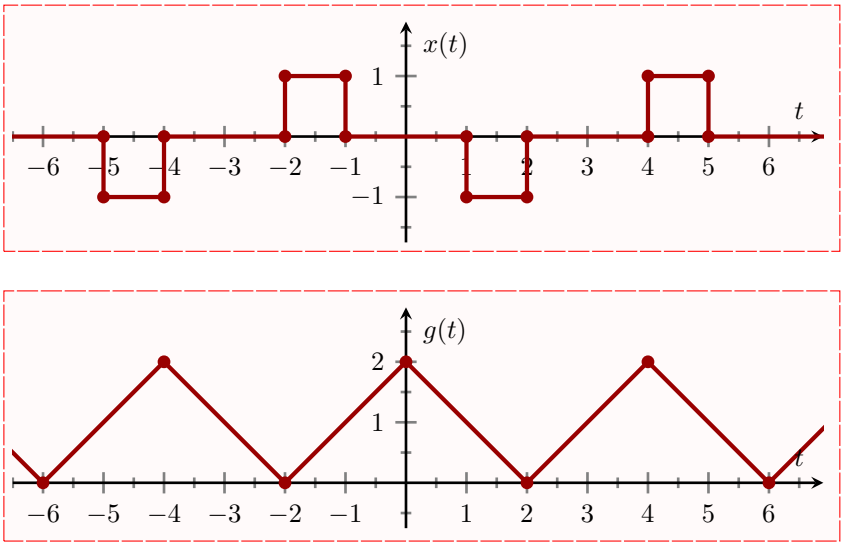
Given that the Fourier series coefficients of periodic impulse train defined as

$$y(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT),$$

are

$$b_k = \frac{1}{T},$$

determine the Fourier series of the coefficients of following signals $x(t)$ and $g(t)$:



Tutorial 5-7

Suppose we are given following information about a signal $x(t)$

1. $x(t)$ is real and odd
2. $x(t)$ is periodic with period $T = 2$
3. The Fourier coefficients are a_k, such that $a_k = 0$ for $k > 1$
4. $\frac{1}{2}\int_0^2 \left|x(t)\right|^2 dt = 1$

Specify two different signals that satisfy these conditions.