EE3210 Signals & Systems

Due on Midnight, April 2, 2020

Homework #2

1. Total mark is 20 points (= 4 points per problem × 5 problems)
2. Solution will be posted on April 3rd on Canvas website
3. Submission due by April 2, 2020, midnight. We will not accept late submission.
4. Online submission through Canvas
   - Scan or taking a photo of your anwser sheet, then upload to Canvas
   - After initial submission to Canvas, you can resubmit through email to yjchun@cityu.edu.hk
     - For revision purpose or if the submitted file is corrupted

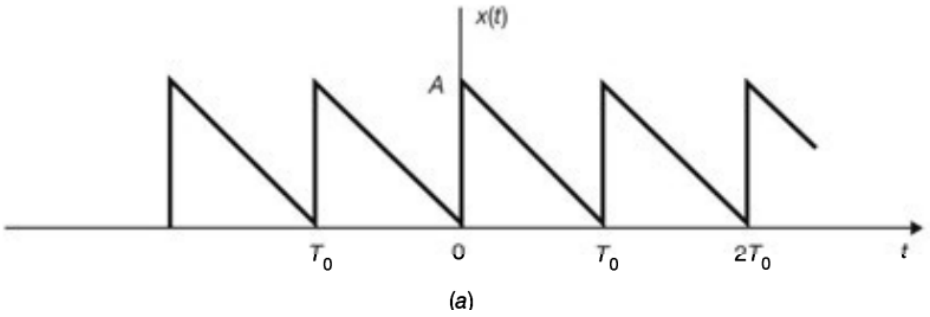
Problem 1

Let's consider the triangular wave $x(t)$ as shown below.

$$x(t) = A\left(1 - \frac{t}{T_0}\right), \quad 0 \le t < T_0, \quad \text{and } x\left(t + T_0\right) = x(t)$$

a) Find the complex exponential Fourier series of $x(t)$

b) Find the triangular Fourier series of $x(t)$



(a)

Problem 2

Find the Fourier transform of the following signals ($\alpha > 0$)

a) $x(t) = e^{-\alpha t^2}$

b) $x(t) = e^{-\alpha |t|}$

Problem 3

Consider a continuous time LTI system where the input and the output are related by the following differential equations

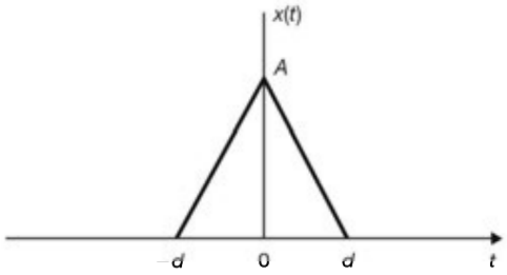
$$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$$

a) Find the impulse response of this system.

b) Find the output of this system if $x(t) = e^{-4t}u(t) - te^{-4t}u(t)$.

Problem 4

a) Find the Fourier transform of the triangular pulse signal shown below



b) Find the inverse Fourier transform of

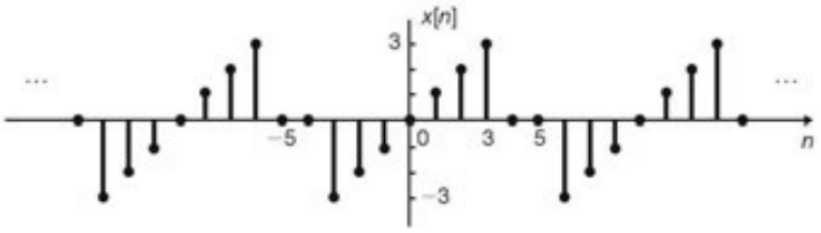
$$X(f) = \frac{1}{2 - f^2 + j3f}$$

c) Find the 80 percent energy containment bandwidth for the signal

$$x(t) = \frac{1}{t^2 + a^2}, \quad a > 0$$

Problem 5

a) Find the discrete-time Fourier series of the sequence $x[n]$ as plotted below



b) Find the discrete-time Fourier transform of the sequence $x[n]$ as shown below