

Fall 2018 - Problem Set 4

ECE 301: Signals and Systems

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Due Date : October 26, 2018

Instructions

1. Please write clearly and legibly.
2. Your solutions must include detailed steps and/or explanations. Do not simply state the answer.
3. Write your full name(first,last), PUID on your homework submission.
4. All problems carry almost equal weight.

Problem 1

Derive the Continuous Fourier Transform for aperiodic signals. Start with the Fourier Series representation of periodic signals.

Problem 2

Compute the Fourier Series coefficients for the following signal using the multiplication and linearity properties

$$\cos\left(\frac{3\pi n}{4} + \frac{\pi}{4}\right) \sin\left(\frac{3\pi n}{4}\right) + \sin\left(\frac{5\pi n}{3} + \frac{\pi}{4}\right) \cos\left(\frac{5\pi n}{3}\right)$$

Problem 3

Let $x[n]$ be a discrete periodic signal with fundamental period N equal to 25. The discrete Fourier Series coefficients of $x[n]$ are a_k as given :

$$a_k = \begin{cases} 4, & k = 0 \\ -2, & 1 \leq k \leq 9 \\ 2, & 10 \leq k \leq 19 \\ 3, & 20 \leq k \leq 24 \end{cases}$$

- a Find $\sum_{k=50}^{74} x[n]$
- b Calculate the average power of the signal.
- c Find $x[100]$
- d find $x[126]$
- e Calculate Fourier Series Coefficients of $x[n-4]$

Problem 4

Find the Fourier Transform of the following signals.

- a $e^{-3(t-2)}u(t-5)$
- b $x(t)$ in Figure 1.

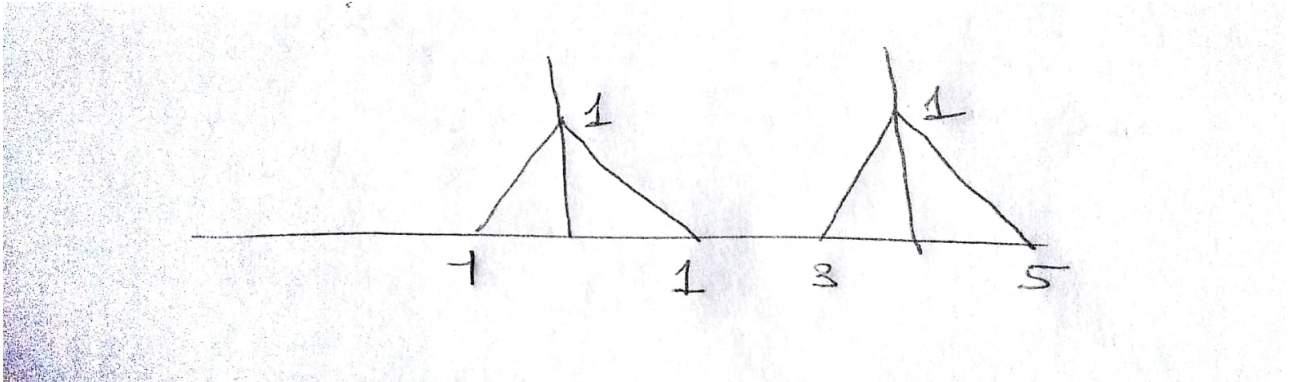


Figure 1: $x(t)$. Notice the signal is not periodic.

Problem 5

Consider an LTI system with the impulse response.

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

Find the Fourier series representation for the output $y(t)$ for each of the inputs below :

a $x_1(t) = \sum_{k=-\infty}^{\infty} \delta(t - 4k)$

b $x_2(t)$ in Figure 2.

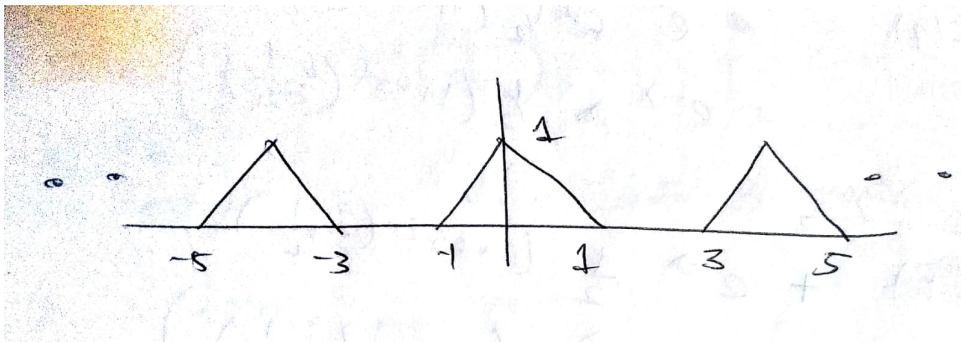


Figure 2: $x_2(t)$