

Spring 2019 - Problem Set 6

ECE 301: Signals and Systems

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Due Date : April 19, 2019

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 equal weight.

Problem 1

- a Find the DTFT of $(\frac{1}{4})^{n-1} u[n]$
- b Find the DTFT of $\delta[-n] + 5\delta[n + 2] + 3\delta[n - 6]$
- c Find DTFT of $x[n]$ in Figure 1.

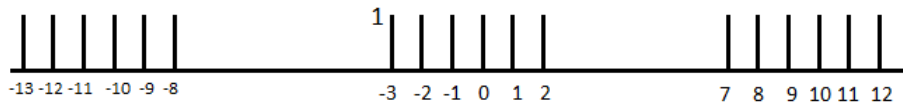


Figure 1: $x[n]$

Problem 2

Consider an LTI system described by the following differential equation

$$x(t) = \frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t)$$

The input is $x(t) = e^{-t}u(t)$. What is the output $y(t)$?

Problem 3

- (i) Derive the Discrete Time Fourier Transform for finite duration signals from Discrete Time Fourier Series for period signals. What is the condition for convergence?
- (ii) Find the DTFT of $x[n]$ in Figure 2.

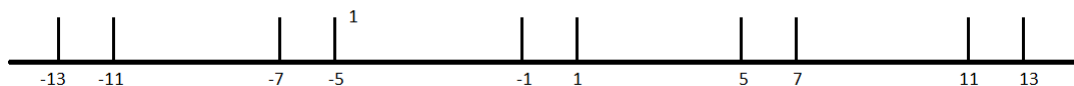


Figure 2: $x[n]$

Problem 4

The impulse response to an LTI system is

$$h[n] = \left(\frac{1}{4}\right)^n u[n]$$

Find the output when the input is $x[n] = \left(\frac{1}{3}\right)^n u[n]$

Problem 5

Given the DTFT $Y(e^{j\omega})$ of a signal $y[n]$, answer the following questions

$$Y(e^{j\omega}) = \cos(\omega)$$

a Is $y[n]$ real?

b Is $y[n]$ even?

c Evaluate $\sum_{n=-\infty}^{\infty} y[n]$

d Evaluate $\sum_{n=-\infty}^{\infty} (-1)^n y[n]$