

# EE3025 Assignment-1

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Download all python codes from

<https://github.com/dks2000dks/IIT-Hyderabad-Semester-Courses/tree/master/EE3015-EE3025/Assignment-1/Part-1/Report/codes>

and latex-tikz codes from

<https://github.com/dks2000dks/IIT-Hyderabad-Semester-Courses/tree/master/EE3015-EE3025/Assignment-1/Part-1/Report>

## 1 PROBLEM

1.1. Let

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (1.1.1)$$

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2) \quad (1.1.2)$$

1.2. Compute

$$X(k) \triangleq \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (1.2.1)$$

and  $H(k)$  using  $h(n)$ .

## 2 SOLUTION

2.1.

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (2.1.1)$$

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2) \quad (2.1.2)$$

Impulse Response of the LTI system is the output of the system when Unit Impulse Signal is given as input to the system.

So, Impulse Response of the System is

$$h(n) + \frac{1}{2}h(n-1) = \delta(n) + \delta(n-2) \quad (2.1.3)$$

$h(n)$  is an IIR Filter.

2.2. DFT of a Input Signal  $x(n)$  is

$$X(k) \triangleq \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (2.2.1)$$

2.3. DFT of a Impulse Response  $h(n)$  is

$$H(k) \triangleq \sum_{n=0}^{N-1} h(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (2.3.1)$$

2.4. Code for Computing DFT of  $x(n)$  and  $h(n)$

**Solution:**

Assuming length of  $h(n)$  is 200 for better plotting of Frequency Components.

Code is in

codes/ee18btech11014.py

Magnitude and Phase Plots of  $X(k)$  and  $H(k)$

