

UNIVERSITY OF THE WEST INDIES
CAVE HILL CAMPUS

Department of Computer Science, Mathematics & Physics

ELET3230 - Digital Signal Processing

Assignment 1

Due: October 31, 2020

1. Consider the difference equation:

$$y[n] = 0.5y[n - 1] + x[n] - 2.5x[n - 1]$$

- (a) Draw a block diagram for this digital filter [3]
- (b) Determine the impulse response $h[n]$ for the filter [2]
- (c) If the input to this filter is the digital signal

$$x[n] = (n + 1)(u[n] - u[n - 4])$$

Determine the output, $y[n]$ (for $n = 0$ to 5), by convolving the impulse response from part (b) with this input signal. [7]

- (d) Verify your answer to (c) using the difference equation of part (a) [5]

2. A stable DSP has a frequency response given by:

$$H(\Omega) = \frac{Y(\Omega)}{X(\Omega)} = \frac{0.5}{1 + 0.8e^{-j\Omega}}$$

- (a) Find the difference equation for this DSP [4]
- (b) Find the first 5 values of its Step Response [6]
- (c) Calculate the Steady State value for this DSP [3]

3. An analog signal $S(t) = 4 \cos\left(3\pi t + \frac{\pi}{4}\right) + \cos\left(6\pi t + \frac{\pi}{2}\right)$ is sampled at 50 Hz. to create the digital signal $x[n]$

Calculate the value of $x[2]$ [2]

If $x[n]$ is passed through a filter with difference equation

$$y[n] = x[n] - x[n - 1] \quad \text{Find } y[2] \quad [3]$$