DIGITAL SIGNAL PROCESSING (CP-301)
Assignment No 2
CLO-2

Submission Date: 22-12-2021
Instructions:
- Individual Assignment

Q No 1: An LTI system has impulse response $h[n] = 5(-1/2)^n u[n]$. Use the Fourier transform to find the output of this system when the input is $x[n] = (1/3)^n u[n]$.

Q No 2: Determine and plot the DTFT magnitude and phase spectra of the following signals.

(a) $x_1[n] = (1/3)^n u[n-1]$

(b) $x_2[n] = (1/4)^n \cos(\pi n/4) u[n-2]$

(c) $x_3[n] = \text{sinc}(2\pi n/8) * \text{sinc}\{2\pi(n-4)/8\}$

Q No 3: Determine the inverse z-transform of the following signals.

(a) $X(z) = \dfrac{1}{(1+\frac{1}{2}z^{-1})^2(1-2z^{-1})(1-3z^{-1})}$,   stable sequence

(b) $X(z) = e^{z^{-1}}$

(c) $X(z) = \dfrac{z^3 - 2z}{z-2}$,   left-sided sequence

Q No 4: Consider a causal system with input $x[n]$ and output $y[n]$. If the input is given by

$$x[n] = -(1/3)(1/2)^n u[n] - (4/3)2^n u[-n-1],$$

the output has a z-transform given by

$$Y(z) = \dfrac{1-z^{-2}}{(1-\frac{1}{2}z^{-1})(1-2z^{-1})}.$$

(a) Determine the z-transform of the input $x[n]$.
(b) Find all possible choices for the impulse response of the system.

Q No 5: Sketch the pole-zero plot for each of the following z-transform and shade the region of convergence.

(a) $X_1(z) = \dfrac{1-\frac{1}{2}z^{-1}}{1+2z^{-1}}$,   ROC: $|z| < 2$

(b) $X_2(z) = \dfrac{1-\frac{1}{3}z^{-1}}{(1+\frac{1}{2}z^{-1})(1-\frac{2}{3}z^{-1})}$, $x_2[n]$ causal

(c) $X_3(z) = \dfrac{1+z^{-1}-2z^{-2}}{1-\frac{13}{6}z^{-1}+z^{-2}}$, $x_3[n]$ absolutely summable.