JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 2 EXAMINATION- APRIL-2023

COURSE CODE (CREDITS): 18B1WEC636 (2) MAX. MARKS: 25

COURSE NAME: Fundamentals of Digital Signal Processing & Applications

COURSE INSTRUCTORS: Dr. Vikas Baghel MAX. TIME: 1.5 Hours

Note: *All questions are compulsory. Marks are indicated against each question in square brackets.*

Q1. **a)** Find $x[0]$ if $X(z) = \frac{3z^2}{(z+3)(z-3)}$. **[2]** **[CO2]**

b) Determine the Z-transform, corresponding ROC and the pole-zero diagram of the following signals **[4]**

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

ii. $x[n] = -2^n u[-n-1]$

Q2. **a)** Consider the sequence $x[n] = a^n u[n] + b^n u[n]$, where $u[n]$ denotes the unit-step sequence and $0 < |a| < |b| < 1$. Find region of convergence (ROC) of the z-transform of $x[n]$. **[3]** **[CO2]**

b) Determine the Z-transform of $h[n] = \{3, -1, \underset{\uparrow}{1}, 2\}$. **[2]**

Q3. **a)** The transfer function of the LTI system is $H(z) = \frac{z}{(z-1)}$; ROC: $|z| < 1$. Find impulse response $h[n]$. **[2]** **[CO2]**

b) Locate Poles and Zeros of $X(z) = \frac{1-2z^{-1}}{1+\frac{5}{2}z^{-1}+z^{-2}}$. **[3]**

Q4. **a)** For the step input $x[n] = u[n]$, evaluate the output $y[n]$ of the LTI system having system function $H(z) = \frac{z-1}{z-0.5}$. **[4]** **[CO4]**

b) Consider a discrete LTI system which is characterized by the system function **[5]**

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Specify the ROCs of $H(z)$ for the following conditions:

i. The system is stable

ii. The system is causal

iii. The system is causal as well as stable.