Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B.Tech.

Mid Semester Examination (Spring, March-2023)

Branch : ECE **Semester** : VIth

Title of the Course : Digital Signal Processing **Course Code** : ECB 352

Time: 1 Hour 30 Minutes **Maximum Marks: 25**

Note: *All questions are compulsory.*

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Represent discrete-time signals analytically and visualize them in the time domain. Explain the basic concept of Digital Signal Processing.	Understanding (Level II)
CO2	To apply and implement various transforms in real-time applications.	Applying (Level III)
CO3	To apply the efficient computation method of discrete Fourier, transform for the real-time applications. Understand the Transform domain and its significance and problems related to computational complexity	Applying (Level III)
CO4	Design different types of digital filters.	Evaluating (Level V)

Course Outcomes(CO's)	CO1	CO2
Questions No.	Q1, Q2	Q3, Q4, Q5 & Q6

Answer the following questions.

Q1. **(a)** Discuss about the causal and non-causal systems with example. How we can predict whether the given system is stable or not? **[4 Marks]**

(b) Explain whether the system is LTI systems or not.

$$y(n) = \begin{cases} x(n) + x(n-2) & for\ n \geq 0 \\ 0 & for\ n < 0 \end{cases}$$

Q2. **(a)** Describe whether the system $y(n) = x(n) + \frac{1}{2x(n-2)}$ is linear or not. **[4 Marks]**

(b) Estimate the energy and power of the signal

$$x(n) = \sin(\tfrac{\pi}{3}n).$$

Q3. Calculate the circular convolution of two sequences using graphical method only. **[4 Marks]**

$x_1(n) = \{1, 2, -1, -2, 3, 1\}$

$x_2(n) = 3[u(n)-u(n-1)] + 2[u(n-1)-u(n-2)] + [u(n-2) - u(n-3)]$

Q4 Calculate the input sequence for the given DFT sequence $X(k) = \{4, -j2, 0, j2\}$ **[4 Marks]**

Q5. Solve the $X(z)$ for all possible inverse Z-transform using long division method **[4 Marks]**

$$X(z) = \frac{z^2 + z + 2}{(z^3 - 2z^2 + 3z + 4)}; \quad ROC;\ |z| < 1$$

Q6. Calculate the Z-Transform and ROC of the given discrete time signal. Also plot the ROC and pole-zero location. **[5 Marks]**

$$x(n) = 2\left(\frac{5}{6}\right)^n u(-n-1) + 3\left(\frac{1}{2}\right)^{2n} u(n)$$