National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	: B.Tech (ECE)	**Semester**	: VI
Title of the Course	: Digital Signal Processing	**Course Code**	: ECB 352

Time: 2 Hours

Maximum Marks: 25

Note : All questions are compulsory.

Q1. Find the energy and power of the given discrete time signal   [3 Marks]

$$x(n) = \begin{cases} n^2 & 0 \le n \le 3 \\ 10 - n & 4 \le n \le 6 \\ n & 7 \le n \le 9 \\ 0 & otherwise \end{cases}$$

Q2. Define causal and non causal systems. How we can predict whether the given system is stable or not? Determine whether the given system with impulse response is (i) Causal (ii) Stable.   [4 Marks]

$$h(n) = [u(n) - u(n-4) + \delta(n-4)]a^n \qquad where \ \ 1 < a < 4$$

Q3. Determine the convolution of following sequences   [3 Marks]

$$x(n) = 4[u(n) - u(n-1)] + 2\delta(n-1) + \delta(n-2) + 3[u(n-3) - u(n-4)]$$
$$h(n) = [u(-n-1) - u(-n-2)] + 2\delta(n) + 2[u(-n+1) - u(-n)] + \delta(n-2)$$

Q4. Using properties of Z-Transform, determine   [3 Marks]

(a) Cross correlation of sequences; $x_1(n) = \{1,3,2,1\}$ and $x_2(n) = \{2,4,1,2\}$

(b) Initial and final values of $x(n)$, if $X(z) = \dfrac{z+2}{4(z-1)(z+0.7)}$

Q5. Find the Z-Transform of the given discrete time signal and plot its ROC.   [3 Marks]

$$x(n) = -n2^n u(-n-1)$$

Q6. Find the Inverse Z-transform using long division method.   [3 Marks]

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

Q7. Find 5-point circular convolution of two sequences using concentric circle method (graphical method).   [3 Marks]

$$x_1(n) = (1.5)^n \qquad 0 \le n \le 2$$
$$x_2(n) = 2n - 3 \qquad 0 \le n \le 3$$

Q8. Find the IDFT of $X(k) = \{4, -j2, 0, j2\}$ [3 Marks]