

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

B.Tech-V Semester (ECE)

COURSE CODE(CREDITS): 18B11EC511 (4)

MAX. MARKS: 35

COURSE NAME: PRINCIPLES OF DIGITAL SIGNAL PROCESSING

COURSE INSTRUCTORS:Dr. Nishant Jain

MAX. TIME: 2 Hour

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	CO	Marks
Q1	<p>a. Represent the sequence $x[n] = \{ 4,2,-1, 1, 3,2,1,5 \}$ as a sum of shifted unit impulses.</p> <p style="text-align: center;">↑</p> <p>b. With the help of a block diagram and corresponding equations. state the difference between parallel connections and cascade connections of two LTI systems.</p> <p>c. Determine the step response of the LTI system with impulse response: $h[n] = a^n u[n]$.</p>	CO1	2+2+3 = 7
Q2	<p>a. Determine the frequency response of the following causal systems: $y[n] - (1/4)y[n-1] - (3/8)y[n-2] = x[n] + x[n-1]$</p> <p>b. What is the causality condition for an LTI system?</p> <p>c. State the necessary and sufficient condition on the impulse response for stability.</p>	CO1 CO4	3+1+1 = 5
Q3.	<p>a. Find the z-transform of the following discrete time system: $h[n] = \left[-\frac{1}{5}\right]^n u[n] + 5 \left[\frac{1}{2}\right]^{-n} u[-n-1]$ Additionally, determine the region of convergence (ROC) for this system and illustrate it on the z-plane. From the ROC, assess the stability of the system.</p> <p>b. With respect to z-transform, state and explain any three properties of the Region of Convergence.</p>	CO4	4+3=7

Q4	<p>a. Discuss the constraints of the Discrete Time Fourier Transform (DTFT) and the necessity of calculating the Discrete Fourier Transform (DFT) for signals in the discrete time domain.</p> <p>b. Determine the DFT of the sequence $x[n] = \{1,1\}$ considering $N=4$. Also draw a frequency response of the magnitude of $X(k)$ obtained.</p>	CO2	3+4=7
Q5.	<p>a. Calculate the circular convolution of the two signals: $x[n] = \{1, 1, 2, 1\}$ and $h[n] = \{1, 2, 3, 4\}$ Additionally, find the time domain signal by performing the inverse Discrete Fourier Transform (IDFT) on the result derived from the circular convolution.</p> <p>b. The first five points of the 8-point DFT of a real valued sequence are $\{28, -4 + j 9.565, -4 + j4, -4 + j 1.656, -4\}$. Determine the remaining three points.</p> <p>c. With respect to DFT, prove the following:</p> $W_N^r = W_N^{r \pm N} = W_N^{r \pm 2N} = \dots$	CO3 CO5	5+2+2 =9