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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST–2 EXAMINATION – 2026

B.Tech–VII Semester (CSE)

COURSE CODE (CREDITS): 18B1WEC636 (2)

COURSENAME: Fundamentals of Digital Signal Processing &Applications

MAX. MARKS: 25

COURSE INSTRUCTORS: Dr. Vikas Baghel

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

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

(c) Use of calculators is allowed.

Q.No	Question	CO	Marks
Q1	**(a)** A discrete-time LTI system is described by $$y[n] - 0.5y[n-1] = x[n], \quad y[-1] = 0.$$ Determine: (i) the impulse response $h[n]$, (ii) the step response for $x[n] = u[n]$, and (iii) whether the system is BIBO stable (justify).	CO1	[4]
	(b) Using the sequences $$x[n] = \{1, 2, 1, 0, 0, 0, 0, 0\}, \qquad h[n] = \{1, 1, 1\},$$ (i) Compute the 8-point DFT $X[k]$ and identify the dominant frequency bins, (ii) Explain how linear filtering $y[n] = x[n] * h[n]$ is implemented using DFT-based convolution.		[3]
Q2	**(a)** Find the Z-transform and region of convergence (ROC) for the following sequences: (i) $x_1[n] = (0.6)^n u[n]$, (ii) $x_2[n] = -(0.75)^n u[-n-1]$, (iii) $x_3[n] = (0.5)^n u[n] + (-0.5)^n u[-n-1]$.	CO1	[3]

Q.No	Question	CO	Marks
	(b) Determine the inverse Z-transform $x[n]$ of $X(z) = \dfrac{1-0.2z^{-1}}{(1-0.5z^{-1})(1-0.8z^{-1})}$ for the following ROCs: (i) $\lvert z\rvert > 0.8$, (ii) $\lvert z\rvert < 0.5$, (iii) $0.5 < \lvert z\rvert < 0.8$.		[3]
Q3	**(a)** Compute the 8-point DFT of $x[n] = \{1,2,1,0,0,0,0,0\}, \qquad 0 \le n \le 7.$ Also compute the corresponding IDFT to verify your result.	CO2	[3]
	(b) Use the DFT to compute the linear convolution of $x[n] = \{1,2,1\}, \qquad h[n] = \{1,-1,2\}.$ Show the required zero padding and justify your chosen DFT length.		[3]
Q4	**(a)** A finite-length signal $x[n]$ has 16-point DFT $X[k]$. A low-pass filter is applied in the frequency domain by $H[k] = \begin{cases} 1, & k = 0,1,2,3,13,14,15, \\ 0, & \text{otherwise.} \end{cases}$ Write the expression for filtered output $y[n]$, and explain how $Y[k]$ is obtained from $X[k]$.	CO3	[3]
	(b) For block convolution using overlap-add, derive a suitable block length L for an FIR filter of length $M = 21$ when 64-point FFTs are used. State the number of overlapped samples and explain why.		[3]