Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 80001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Seventh Semester
Electrical and Electronics Engineering
U19EE726 – DIGITAL SIGNAL PROCESSING
(Regulation 2019)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

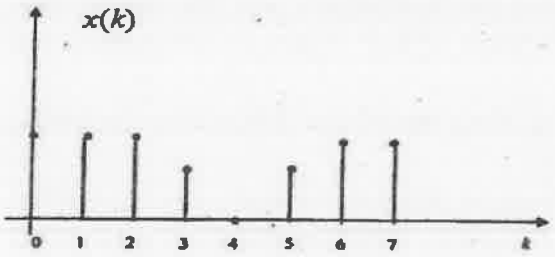
PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define a discrete-time system.	2	K1	CO1
2.	State the Nyquist rate and highlight its importance in the sampling process.	2	K1	CO1
3.	Differentiate between the Z-transform and the discrete-time Fourier transform in terms of their regions of convergence and applications.	2	K2	CO2
4.	Give the purpose of using the inverse Z-transform in solving difference equations.	2	K2	CO2
5.	State any two differences between Decimation-in-Time (DIT) and Decimation-in-Frequency (DIF) approaches in radix-2 FFT algorithms.	2	K2	CO3
6.	Compare the computational complexity of direct DFT computation against the radix-2 FFT algorithm.	2	K2	CO3
7.	List any two commonly used window functions in FIR filter design.	2	K1	CO4
8.	State the characteristic feature of a Butterworth filter.	2	K1	CO4
9.	List any two features of the TMS320C floating-point processor.	2	K2	CO5
10.	Mention the key differences between fixed-point and floating-point architectures in the TMS320C DSP series.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.		Questions	Marks	KL	CO
11.	a)	Describe in detail the various classifications of systems based on their properties, such as continuity, linearity, causality, stability, dynamic nature, recursiveness, and time variance, with suitable examples.	13	K1	CO1
		(OR)			
	b)	Discuss the concepts related to signals and their processing, including classification of signals (continuous/discrete, energy/power), mathematical representation, spectral density, sampling techniques, quantization, quantization error, Nyquist rate, and aliasing, and explain their significance in digital signal processing.	13	K1	CO1
12.	a)	Describe the properties of the Z-transform and illustrate the use of the inverse Z-transform in solving difference equations in discrete-time systems with suitable examples.	13	K2	CO2
		(OR)			
	b)	Explain the process of analyzing discrete-time systems using Z-transform, including stability analysis, frequency response, and convolution concepts, and describe how magnitude and phase representation are obtained using the Discrete-Time Fourier Transform (DTFT).	13	K2	CO2
13.	a)	i. A finite duration sequence x(n) of length eight has the DFT X(k) as shown in the figure below 	7	K4	CO3
		ii. A new sequence y(n) of length 16 is defined by: $y(n) = x(\frac{n}{2})$ for n= even = 0 for n=odd Sketch the DFT Y(k) as a function of 'k'. Find the four-point FFT of x(n) = {1,0,11} using the decimation in time algorithm.	6		
		(OR)			

	b)	Analyze the computation of the Discrete Fourier Transform (DFT) using the Fast Fourier Transform (FFT) algorithm. Explain the working principles of radix-2 FFT in both Decimation-in-Time (DIT) and Decimation-in-Frequency (DIF) approaches with neat butterfly diagrams. Discuss how these methods reduce computational complexity compared to direct DFT calculation.	13	K4	CO3
14.	a)	Describe the realization structures of FIR and IIR filters. Also, explain the parallel form and cascade form implementations with clear diagrams.	13	K1	CO4
		(OR)			
	b)	Explain the Butterworth and Chebyshev filter approximations. State their important properties and compare their characteristics with the frequency response curves.	13	K1	CO4
15.	a)	Describe the architecture and key features of TMS320C series fixed-point and floating-point processors and discuss their addressing formats.	13	K2	CO5
		(OR)			
	b)	Describe the functional modes of TMS320C DSP processors and discuss their applications in real-time video coding.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	A digital signal processing engineer is designing a system to analyze and filter audio signals using a TMS320C DSP. The system must handle discrete-time signals, compute their frequency content, and implement suitable digital filters. Analyze the system's behavior, including signal and system classification, stability, frequency response, and the design of FIR and IIR filters (Butterworth and Chebyshev). Also, examine how the features of TMS320C DSP (fixed-point and floating-point architectures) impact real-time signal processing. Include sketches of magnitude and phase responses where applicable.	15	K2	CO5
		(OR)			
	b)	In a digital signal processing project, a discrete-time audio signal requires frequency analysis and filtering. Analyze the signal by determining its DFT and describe how radix-2 FFT algorithms (DIT and DIF) enhance efficiency. Design a low-pass FIR filter with a suitable windowing method and an IIR Butterworth filter using bilinear transformation to meet specified design criteria. Compare the frequency responses of Butterworth and Chebyshev filters and evaluate their impact on signal quality and system performance. Include sketches wherever appropriate.	15	K4	CO3