Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER– VI • EXAMINATION – SUMMER-2017

Subject Code:X61103 **Date: 04/05/2017**

Subject Name: Digital Signal Processing

Time: 10.30AM to 01:00PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What is aliasing in discrete time systems? What is the solution to avoid it?	**07**
	(b)	Consider a system with impulse response $h(n) = u(n) - u(n-N)$. The input is $x(n) = a^n u(n)$.Find the output of the system.	**07**
Q.2	**(a)**	Consider a system $y(n) = ay(n-1) + x(n)$.Find the output of the system with the input $x(n)=K\delta(n)$.Use recursive method.	**07**
	(b)	Enlist the symmetry properties of the Fourier transform.	**07**
		OR	
	(b)	Prove the following Fourier transform theorems: (i)Frequency shifting (ii)Differentiation (iii)Modulation	**07**
Q.3	**(a)**	Obtain the z-transform of the following : (i)$x(n) = (-1/3)^n u(n) - (1/2)^n u(-n-1)$ (ii)$x(n) = a^n u(n)$ $0 \le n \le N-1$	**07**
	(b)	Explain the properties of Region of Convergence of the z-transform.	**07**
		OR	
Q.3	**(a)**	Obtain the inverse z-transform of the following: (i)$X(z) = (1+z^{-1})^2 / (1 - (1/2)z^{-1})(1 - z^{-1})$, $\lvert z\rvert > 1$ (ii)$X(z)=\log(1 + a z^{-1})$, $\lvert z\rvert > \lvert a\rvert$	**07**
	(b)	Discuss the types of structures for linear phase FIR filter.	**07**
Q.4	**(a)**	Draw the Direct form-I, Direct form-II,Cascade and Parallel form structures for the following system: $H(z) = (1+z^{-1})^2 / (1 - (1/2)z^{-1})(1 - (1/4) z^{-1})$	**07**
	(b)	What is windowing in FIR systems? Discuss the various window functions.	**07**
		OR	
Q.4	**(a)**	Design a low pass Butterworth Digital filter with the following specifications. Use Impulse invariance method: $0.89125 \le \left\lvert H\left(e^{j\omega}\right)\right\rvert \le 1 \qquad 0 \le \lvert\omega\rvert \le 0.2\pi$ $\left\lvert H\left(e^{j\omega}\right)\right\rvert \le 0.17783 \qquad 0.3\pi \le \lvert\omega\rvert \le \pi$	**07**
	(b)	Discuss the limit cycle because of round off and overflow in IIR system.	**07**
Q.5	**(a)**	Prove the linearity and circular shift property of the Discrete Fourier Transform.	**07**
	(b)	Find the 4-point circular convolution of the following sequences: $x(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2) + 4\delta(n-3)$ $h(n) = 5\delta(n) + 4\delta(n-1) + 3\delta(n-2)$	**07**
		OR	
Q.5	**(a)**	Compare (i)FIR and IIR filter (ii)Causal and Non causal System.	**07**
	(b)	Write a short note on the applications of digital signal processing.	**07**

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