GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–VII (OLD) EXAMINATION – WINTER 2020

Subject Code:171003   **Date:25/01/2021**
Subject Name:Digital Signal Processing
Time:10:30 AM TO 12:30 PM   **Total Marks: 56**

Instructions:
1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1	**(a)**	Draw the block diagram of a typical discrete time system and explain in brief. What are the advantages and disadvantages of digital signal processing over analog signal processing ?	**07**
	(b)	Perform the linear convolution of the following two sequences: $x_1(n) = 2\delta(n)+ \delta(n-1) - \delta(n-2) + 2\delta(n-3)$ $x_2(n) = \delta(n) - \delta(n-1) + \delta(n-2)$	**07**
Q.2	**(a)**	Enlist the properties of the z-transform? Prove the convolution property of z-transform.	**07**
	(b)	Determine the z-transform of the following: (i) $x(n) = (-1/3)^n u(n) - (-1/2)^n u(-n-1)$ (ii) $x(n) = a^n , 0 \leq n \leq N-1$	**07**
Q.3	**(a)**	Determine the inverse z-transform of the following: (i)$X(z) = (1+z^{-1})^2 / (1-(1/2)z^{-1})(1-z^{-1}) , |z| >1$ (ii)$X(z)=\log(1+az^{-1}) , |z| > |a|$	**07**
	(b)	Derive the expression of reconstruction of a bandlimited signal from its samples.	**07**
Q.4	**(a)**	A discrete time system is given below: $H(z) = (1+ z^{-1})^2 / (1- 0.75z^{-1} + 0.125z^{-2})$ Draw the following structures of the system: (i)Direct-form-I (ii) Direct-form-II (iii)Cascade (iv)Parallel	**07**
	(b)	What is a linear phase system? Discuss different types of FIR linear phase systems.	**07**
Q.5	**(a)**	Discuss the basic structures implementing IIR discrete time systems.	**07**
	(b)	Explain the limit cycles in fixed point realizations of IIR digital filters. What is the solution to avoid limit cycles ?	**07**
Q.6	**(a)**	Discuss the discrete time IIR filter design by (i)Impulse Invariance method (ii)Bilinear transformation	**07**
	(b)	Design an FIR low-pass filter satisfying the specification $0.98 < H(e^{jw}) < 1.02.$ $0\leq |w|\leq0.63\pi$ $-0.15 < H(e^{jw}) < 0.15.$ $0.65\leq |w|\leq\pi$ By applying a Kaiser window to the impulse response $h_d[n]$ for the ideal discrete time low-pass filter with cutoff $w_c=0.64\pi$. find the value of β and M required to satisfy this specification.	**07**

Q.7 **(a)** Enlist the properties of the Discrete-Fourier transform? Prove the **07** frequency modulation property of Discrete-Fourier transform.

(b) Write a short note on Decimation-in-frequency FFT algorithm. **07**

Q.8 **(a)** Perform the 4-point circular convolution of the following two sequences: **07**
$x(n) = \delta(n) + 2\delta(n-1) + 3\delta(n-2) + 4\delta(n-3)$
$h(n) = \delta(n) + 2\delta(n-1) + \delta(n-2) + 2\delta(n-3)$

(b) Explain any two applications of Digital Signal Processing. **07**

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