Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject Code:2710501 **Date:08/05/2017**

Subject Name: Digital Signal Processing Algorithms

Time:02:30 p.m. to 05:00 p.m. **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)**	Define: Static system, Causal system, and Time-invariant system. Also determine system $y(n) = x^2(n)$ is static or dynamic, causal or non-causal, linear or non-linear and time-variant or time-invariant.	**07**
	(b)	State and explain the time shifting property of z-transform. Also determine the z-transform and ROC of the signal $x_1(n) = x(n-2)$, where $x(n) = \{1 \quad \underset{\uparrow}{-1} \quad -2 \quad 1 \quad 2\}$ using time shifting property.	**07**
Q.2	**(a)**	Obtain the direct form I, direct form II, cascade and parallel form structures for the system $y(n) = 0.75\, y(n-1) - 0.125\, y(n-2) + x(n) + 0.33\, x(n-1)$.	**07**
	(b)	State and explain properties of DFT.	**07**
		OR	
	(b)	Determine the 4-point DFT of a sequence $x(n) = u(n) - u(n-3)$. Also find magnitude and phase spectrum of DFT.	**07**
Q.3	**(a)**	State and explain circular time shift and circular time reversal property of DFT.	**07**
	(b)	Determine the sequence $x_3(n)$, a circular convolution of $x_1(n) = \{1, 2, 1, 2\}$ and $x_2(n) = \{1, -1, 1, -1\}$ using 4-point DFT and IDFT.	**07**
		OR	
Q.3	**(a)**	Draw a signal flow graph representation of the DIT FFT method for finding 8-point DFT.	**07**
	(b)	Compute 8-point DFT of a sequence $x(n) = \{1, 1, 1, 1, -1, -1, -1, -1\}$ using DIT FFT algorithm and draw the flow diagram.	**07**
Q.4	**(a)**	List and Explain at least two windowing methods for FIR filter design.	**07**
	(b)	Determine the unit sample response $\{h(n)\}$ of a linear-phase FIR filter of length $M = 4$ for which the frequency response at $\omega = 0$ and $\omega = \pi/2$ is specified as $H_r(0) = 1$ and $H_r(\frac{\pi}{2}) = 1/2$.	**07**
		OR	
Q.4	**(a)**	Explain Impulse Invariance method for IIR filter design.	**07**
	(b)	Convert the analog filter with system function $H(s) = (s + 0.1) / \{(s + 0.1)^2 + 9\}$ into a digital IIR filter using the bilinear transformation. Compare the location of the zeros in $H(z)$ with the locations of the zeros obtained by applying the impulse invariance method in the conversion of $H(s)$. (Select $T = 0.1$)	**07**
Q.5	**(a)**	Explain ARMA model for power spectrum estimation.	**07**
	(b)	Write short note on discrete wavelet transform.	**07**

OR

Q.5	**(a)**	Write short note on the Bartlett: a nonparametric method for power spectrum estimation.	**07**
	(b)	List and briefly explain applications of DSP.	**07**

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