Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2150307 **Date: 17/06/2019**

Subject Name: Digital Signal Processing

Time: 02:30 PM TO 05:00 PM **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)**	Give the statement of "Sampling Theorem". Explain briefly the errors arises during sampling process.	**03**
	(b)	Justify the statement giving mathematical proof "Any signal can be expressed using summation of two signal parts where one part is even signal and the other part is odd signal".	**04**
	(c)	Define Signal Processing. Differentiate between Analog signal processing and Digital signal processing, and also list out the applications of Digital Signal Processing.	**07**
Q.2	**(a)**	State the Properties of Z – Transform.	**03**
	(b)	Define following terms: 1. Convolution 2. Correlation 3. Quantization 4. Aliasing	**04**
	(c)	Determine Z – Transform of following sequence: 1. x(n) = {1, 2, 4, 5, 0, 7} 2. x(n) = {1, 2, 4, 5, 0, 7} ↑	**07**
		OR	
	(c)	Obtain Inverse Z – Transform of following function using PFE method and also comment on its ROC $X(Z) = \frac{1}{(Z-1)(Z-3)}$	**07**
Q.3	**(a)**	Enlist the properties of DFT with necessary mathematical equation.	**03**
	(b)	Compute Linear convolution of following given sequence using mathematical method x(n) = {1, 1, 1, 1} ↑ & h(n) = {1, 1, 1, 1} ↑	**04**
	(c)	Calculate 8 point DFT of: x(n) = {1, 2, 1, 2}	**07**
		OR	
Q.3	**(a)**	Write short note on Goertzel algorithm.	**03**
	(b)	Determine r_{xx} & r_{xy} for following sequences: x(n) = {1, 1, 0, 1} ↑ & y(n) = {4, -3, -2, 1} ↑	**04**
	(c)	Explain radix – N/2 DIT FFT algorithm with necessary diagram.	**07**

Q.4	**(a)**	Explain in brief the Transpose representation of Digital IIR system giving one example.	**03**
	(b)	Develop Direct form – II realization of following system: $$H(Z) = \frac{3 + 3.6\,Z^{-1} + 0.6Z^{-2}}{1 + 0.1\,Z^{-1} - 0.2Z^{-2}}$$	**04**
	(c)	Design a linear phase FIR low pass filter of seventh order with cutoff frequency 1 rad/sec using rectangular window.	**07**
		OR	
Q.4	**(a)**	State the difference between Cascade and Parallel realization of digital system giving suitable example.	**03**
	(b)	Obtain Direct form – I realization of following system $$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$	**04**
	(c)	Determine transfer function of digital filter using Impulse Invariance method at 5Hz sampling frequency for given below H(s), $$H(s) = \frac{2}{(s+1)(s+2)}$$	**07**
Q.5	**(a)**	Compare IIR filter and FIR filter.	**03**
	(b)	Explain detection of Alpha waves, Beta waves and Gamma waves using signal processing techniques.	**04**
	(c)	Explain IIR filter design using Bilinear Z – Transform method.	**07**
		OR	
Q.5	**(a)**	Explain mapping of s – plane and Z – plane with neat diagram.	**03**
	(b)	Explain in brief cardiac arrhythmias detection.	**04**
	(c)	What is windowing? Explain in detail the process of converting IIR system in to FIR system using rectangular window method.	**07**

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