Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – II SEMESTER • EXAMINATION – SUMMER 2017

Subject Code: 2724707 **Date:30/05/2017**

Subject Name: Mechatronics 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		What is an IIR filter? Compare its characteristics with an FIR filter. Explain the different steps used in design of IIR filters from analog IIR filters.	**14**
Q:2	**(a)**	Explain the concept of envelope analysis with suitable example.	**07**
Q:2	**(b)**	How will you sample a continuous bandpass signal (B = 5 MHz) that is centred about some frequency (f_c = 20 MHz)?	**07**
		OR	
Q:2	**(b)**	Find the position of poles, zeros, region of convergence and Z transform for the following:	
		1. $x(n) = (0.3)^n u(n) + (-0.2)^n u(n)$	**03**
		2. $x(n) = -(0.6)^n u(-n-1) + (-0.5)^n u(n)$	**04**
Q:3		Compute the circular convolution between following sequences using DFT and IDFT method: $x(n) = \{\mathbf{1},2,3,4\}$ and $y(n) = \{\mathbf{-1},-2,-3,-4\}$	**14**
		OR	
Q:3	**(a)**	The impulse response of a linear time invariant system is $h(n) = \begin{cases} 1 & -2 \le n \le 2 \\ 0 & \text{elsewhere} \end{cases}$. Determine the response of a FIR filter to the input signal $x(n) = \begin{cases} \frac{n}{3} & 0 \le n \le 6 \\ 0 & \text{elsewhere} \end{cases}$	**07**
Q:3	**(b)**	Compute the circular convolution of signals $x_1(n)=\{\mathbf{2},1,2,1\}$ and $x_2(n)=\{\mathbf{1},2,3,4\}$ through linear convolution.	**07**
Q:4	**(a)**	What do you understand by discrete time systems? Explain different discrete time systems with suitable examples.	**07**
Q:4	**(b)**	If $X(k) = \{\mathbf{2}, 1+j, 0, 1-j\}$, find the periodic signal x(n) with N =4.	**07**
		OR	
Q:4	**(a)**	Find the inverse transform of $H(Z) = \frac{z}{3z^2 - 4z + 1}$, if the region of	**07**

convergence are (a) $|z| > 1$ (b) $|z| < 1/3$ (c) $1/3 < |z| < 1$

(b) Compute DFT of sequence of x(n) = {**1**,0,1,0,1} and verify symmetry property. **07**

Q:5 If the x(n) ={**3**,1,5,4,2,1,0,1} , find the X(k) by using decimation in frequency FFT algorithm. **14**

OR

Q:5 (a) Design high pass FIR filter for N = 4 and ω_c = 1.5 rad. Use rectangular and Hamming window. **07**

Q:5 (b) Explain application and importance of digital signal processing in at least four different field of engineering. **07**

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