Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2724707 **Date: 31/05/2016**

Subject Name: Mechatronics Signal Processing

Time:10:30 am to 01:00 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		Explain the Radix-2 FFT algorithm. If the x(n) ={**1**,2,2,3,1,1,4,2} , find the FFT of the x(n).	**14**
Q:2	**(a)**	What are fixed and adaptive filters? Explain how noise introduced in the system can be minimised by adaptive filters.	**07**
	(b)	What is Nyquist rate and aliasing? Explain the sampling of bandpass signal.	**07**
		OR	
	(b)	What do you understand by ROC of Z transform? Show the ROC of Finite and Infinite duration Causal, Anticausal and Two sided signals.	**07**
Q:3	**(a)**	Determine four point DFT of x(n) = δ(n)+2δ(n-2)+δ(n-3).	**07**
	(b)	Explain how linear convolution can be computed from circular convolution.	**07**
		OR	
Q:3	**(a)**	Perform the circular convolution of the signals $x_1(n)$ = {**2**,1,2,1} and $x_2(n)$ = {**1**,2,3,4}.	**07**
	(b)	The impulse response of a linear time invariant system is h(n) = {1,**2**,1,-1}. Determine the response of the system to the input signal x(n)={**1**,2,3,1}.	**07**
Q:4	**(a)**	Find the inverse transform of $H(Z) = \frac{3 + Z^{-1} + Z^{-2}}{1 + 3z^{-1} + 2Z^{-2}}$	**07**
	(b)	Discuss the various applications of digital signal processing in the field of Mechatronics Engineering.	**07**
		OR	
Q:4	**(a)**	Discuss the different types of discrete time systems based on their general properties and characteristics.	**07**
	(b)	State the different properties of DFT and prove any two of them.	**07**
Q:5	**(a)**	What is an IIR filter? Compare its characteristics with an FIR filter.	**07**
	(b)	Explain the different steps used in design of IIR filters from analog IIR filters.	**07**
		OR	
Q:5	**(a)**	What is an FIR filter? What are the advantages and disadvantages of FIR filter? Explain the effect of different windows on filter output.	**07**

(b) Design the low pass filter for the following desired frequency response using rectangular, Hamming and Hanning window. **07**

$$H_d(e^{j\omega}) = \begin{cases} e^{-j\omega 3} & 0 \le |\omega| \le \frac{\pi}{3} \\ 0 & \frac{\pi}{3} \le |\omega| \le \pi \end{cases}$$

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