Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1724707 **Date: 23-06-2014**

Subject Name: Mechatronics Signal Processing

Time: 02:30 pm - 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 Explain and derive the various properties of linear convolution. **07**

B Perform the circular convolution of the following two sequences: **07**

$x_1(n) = \{\underset{\uparrow}{2},1,2,1\}$, $x_2(n) = \{\underset{\uparrow}{1},2,3,4\}$

Q:2 A Discuss any one specific application of DSP in field of Mechanical / Mechatronics Engineering. **07**

B With example, explain difference between **07**

1. time invariant and time variant system
2. causal and non-causal system
3. static and dynamic system

OR

Q:2 B Derive and draw the Fourier transform of following continuous signals: **07**

1. x(t) = A*sin(2´ *p*t)
2. x(t) = $e^{-Ŭt}$, t Ó0, Ŭ > 0
3.

Q:3 Discuss the Z transform, its properties and importance of ROC for LTI system. Find the Z transform, ROC, poles and zeros of the following systems. Also represent ROC, poles and zeros graphically. **14**

1. $x(n) = \alpha^n u(n)$
2. $x(n) = -\beta^n u(-n-1)$
3. $x(n) = \alpha^n u(n) - \beta^n u(-n-1)$

Differentiate these systems based on their ROC and write your comments.

OR

Q:3 A Find the inverse Z- transform using partial fraction expansion: **07**

$$H(z) = \frac{3 + Z^{-1} + Z^{-2}}{1 + 3Z^{-1} + 2Z^{-2}}$$

B Find the inverse Z- transform using residue methods: **07**

$$X(z) = \frac{Z^2 + Z}{(Z-1)^2}$$

Q:4 Determine eight point Discrete Fourier Transform of the following signal. The sampling frequency of the signal is 8000 Hz. **14**

$$x(t) = \cos(2\pi \bullet 3000 \bullet t) + 0.5\cos(2\pi \bullet 2000 \bullet t + 3\frac{\pi}{4})$$

Also discuss all properties of DFT for this signal.

OR

Q:4 A Find the eight point FFT of the following signal, sampling frequency is 8000Hz: **10**

$$x(t) = \sin(2\pi \bullet 1000 \bullet t) + 0.5\sin(2\pi \bullet 2000 \bullet t + 3\frac{\pi}{4})$$

	B	Explain the sampling of band limited signal.	**04**
Q:5	**A**	Explain FIR filters and importance of different windows in design of FIR filters.	**07**
	B	Discuss the design of FIR filters for low pass, high pass and band pass frequency.	**07**
		OR	
Q:5		Explain IIR filters and various methods to design IIR filters with suitable example.	**14**

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