Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I• EXAMINATION – SUMMER 2013

Subject Code: 712903N **Date:13/06/2013**

Subject Name: Digital Signal Controller

Time: 10:30 to 1:00 **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Do as directed : (02 marks each) **14**

(i) State equation for a backward difference system. Will it be causal?
(ii) Define DFT. State its two applications.
(iii) Discuss significance of aliasing for sampling.
(iv) Evaluate ŭ(n-1)* ŭ(n+1) . Comments on result obtained.
(v) Prove that ŭ(n) = u(n) ï u(n-1).
(vi) State relation between Z-transform and DFT.
(vii) Sketch various tolerance limits to approximate an ideal low pass filter.

Q.2 **(a)** Draw and explain the block diagram of basic generic hardware architecture for a signal processor. **07**

(b) Discuss discrete time processing of continuous time signals. **07**

OR

(b) Explain the changing of the sampling rate using discrete time processing. **07**

Q.3 **(a)** Determine the impulse response for the cascade of two LTI systems having impulse response : $h_1(n) = (1/2)^n u(n)$ and $h_2(n) = (1/4)^n u(n)$ **07**

(b) Determine the response of the system **07**
$y(n) = 5/6\ y(n-1) - 1/6\ y(n-2) + x(n)$ to the input signal
$x(n) = ŭ(n) - 1/3\ ŭ(n-1)$.

OR

Q.3 **(a)** Write short note on: Hilbert Transform. **07**

(b) An LTI system is characterized by the difference equation **07**
$x(n-2) - 9x(n-1) + 18x(n) = 0$ with initial conditions $x(-1) = 1$ and $x(-2) = 9$. Find $x(n)$ by using z-transform and state the properties of z-transform used in calculation.

Q.4 **(a)** Obtain the parallel-form structure of the given H(z) for first-order and second order systems. **07**

$$H(z) = \frac{\left(1 + 2z^{-1} + z^{-2}\right)}{\left(1 - 0.75z^{-1} + 0.125z^{-2}\right)}$$

(b) For linear phase FIR filters, how constant group and phase delay is achieved? Enlist design techniques for the same. **07**

OR

Q.4 (a) Discuss (i) All-pass systems and (ii) Minimum phase system. **07**

Q.4 (b) Obtain impulse response of a digital filter to correspond to an analog filter with impulse response $h(t) = 0.5\ e^{-2t}$ and with a sampling rate of 0.1kHz using impulse invariant method only. **07**

Q.5 (a) For x(n) = (1,1,-1,-1) use 4-point DIT, algorithm for FFT and cross check the result using DFT. **08**

(b) An LTI system is described with the following difference equation $y(n) = a\ y(n-1) + b\ x(n)$ for $0 < a < 1$ and $0 < b < 1$. Determine the magnitude and phase of the frequency response of the system. **06**

OR

Q.5 (a) Perform the Circular Convolution of the two sequences $x_1(n)$ = {**2**, 1, 2, 1} and $x_2(n)$ = {**1**, 2,3,4} **08**

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(b) (i) Compare FIR filter with IIR filter in tabular form. **06**
(ii) Compare linear and circular convolution.

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