Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 712903 **Date: 19-06-2014**

Subject Name: Digital Signal Controller

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 mark.**

Q.1 **(a)** (i) Define a Signal. Give detailed classification of signals with example. **08**
(ii) Compare FIR filter with IIR filter in tabular form.

(b) (i) State equation for a forward and back ward difference systems. Out of this two systems, which one will be causal? **06**
(ii) Define DFT. State its two applications.

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

(b) For linear phase FIR filter, how constant group and phase delay is achieved? Also, enlist various design techniques for linear phase FIR filter. **07**

OR

(b) Consider a LTI system with system function as follows: **07**
$Z(s) = (1+2z^{-1} + z^{-2}) / (1 - 0.75 z^{-1} + 0.125 z^{-2})$.Obtain (i) Direct form ï I and (ii) Direct form ï II structure. Also, comments on the result obtained.

Q.3 **(a)** Discuss discrete time processing of continuous time signals. **06**

(b) Find inverse Z ï transform of **08**

(i) $X(z) = \dfrac{1}{(1- 0.25z^{-1})(1 - 0.5 z^{-1})}$ $|z| > (1/2)$.

(ii) $X(z) = \log(1 + a z^{-1})$ $|z| > |a|$.

OR

Q.3 **(a)** Explain the changing of the sampling rate using discrete time processing. **06**

(b) State and prove initial value theorem and final value theorem for Z-transform. Obtain the initial value for $x(z) = 2 + 3z^{-1} + 4 z^{-2}$. **08**

Q.4 **(a)** Enlist various window sequences for FIR filter design and explain any one of them in detail. **08**

(b) Determine discrete ï time Fourier transform of the sequence x (n) = u(n). Comment(s) on the result obtain. **06**

OR

Q.4 **(a)** (i) Draw low-pass filter magnitude characteristics with all necessary tolerance limits. **08**
(ii) Obtain relation between z- transform and discrete Fourier transform.

(b) For the two four-point sequences x(n) = cos (n´ /2) and y(n) = sin(n´ /2). Obtain linear convolution of x(n) with y(n) directly. **06**

Q.5 **(a)** State and prove the following properties of DFT: **08**
(i) linearity (ii) duality (iii) periodicity (iv) Circular shift of a sequence.

(b) Explain DIT- FFT Algorithm using signal flow graphs for N= 4. **06**

OR

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

(b) Write short note on: Hilbert Transform. **06**

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