Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –Ist SEMESTER–EXAMINATION – JULY- 2012

Subject code: 712903N **Date: 09/07/2012**

Subject Name: Digital Signal Controller

Time: 2:30 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.**
4. **Symbols/ Notations used have usual meaning.**

Q.1 **(a)** For the system T {x(n) } = a x(n) + b, determine whether the system is (i) stable (ii) causal (iii) linear (iv) time –invariant (v) memory less or not. **05**

(b) State the sampling theorem, given $x(t) \overset{FT}{\longleftrightarrow} X(w)$.For the spectrum of the continuous-time signal, shown in Fig.1, consider the three cases $f_s = 2f_x$; $f_s > 2f_x$ and $f_s < 2f_x$; draw the spectra, indicating aliasing. **07**

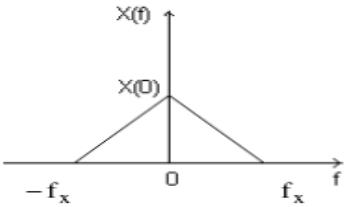

Fig.1

(c) State equation for a forward and back ward difference systems. Out of these two systems, which one will be causal? **02**

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

(b) Describe implementation of DSP algorithms for IIR digital filter. **07**

OR

(b) Using Hilbert Transform, find relationship between magnitude and phase. **07**

Q.3 **(a)** For the two four-point sequences x(n) = cos(nπ/2) and y(n) = sin(nπ/2). Obtain linear convolution of x(n) with y(n) directly. **07**

(b) Consider an LTI system with input x(n) and output y(n) which satisfies the difference equation y(n) = (5/6) y(n-1) – (1/6) y(n-2) + x(n) , obtain response if x(n) = . δ(n) – (1/3) δ(n-1). **07**

OR

Q.3 **(a)** For sequences x(n) = { 1, 0.5} and h(n) ={ 0.5 , 1}, **07**
↑ ↑
obtain linear convolution using DFT.

(b) Consider the signal $x(n) = a^{n}$, $0 \le n \le N-1$, a > 0 and 0 otherwise. Find x(z), state ROC and plot the pole-zero pattern for N=8. **07**

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

(b) Prove that **04**

(i) $\delta(n) = u(n) - u(n-1)$.

(ii) $y(n) = x(2n)$ is a causal system.

(c) Discuss significance of Nyquist rate for sampling. **02**

OR

Q.4 **(a)** Explain the following properties for Fourier - transform. **08**

(i) time -shifting (ii) time- reversal

(iii) time- expansion (iv) scaling.

(b) Draw low-pass filter magnitude characteristics with all necessary tolerance limits. **04**

(c) State and explain convergence conditions for discrete –time Fourier transform. **02**

Q.5 **(a)** List various window sequences for FIR filter design and explain any two of them in detail. **08**

(b) Show that the difference equation $y(n) - ay(n-1) = -ax(n) + x(n-1)$ represents an all-pass transfer function. What is (are) the condition(s) on a for the system to be stable? **06**

OR

Q.5 **(a)** Compare : **08**

(i) IIR filter with FIR filter for various aspects.

(ii) Linear and Circular convolution.

(b) Discuss digital processing of analog signal. **06**

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