Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 712903 N

Subject Name: Digital Signal Controller

Date:11/07/2011 **Time: 10:30 am – 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.**
4. **Notations/symbols used have usual meanings.**

Q.1 **(a)** A system described by relationship $T\{x(n)\} = a\,x(n)+b$; where $a > 0$ and $b > 0$. Find the system is (i) memory –less (ii) stable (iii) causal (iv) linear and (v) time - invariant or not. **05**

(b) Let $X(e^{jw})$ denote the Fourier Transform of the signal **05**
$x(n) = \{\ldots\ldots, -1,0,1,\underset{\uparrow}{2},1,0,1,2,1,0,-1, \ldots.\}$. Plot x(n).

Without explicitly finding out $X(e^{jw})$ find the following :-

(i) X (1) (ii) X (-1)

(iii) Evaluate $\int_{-\pi}^{\pi} X(e^{j\omega})\,d\omega$

(iv) The sequence y (n) whose Fourier Transform is the real part of $X(e^{jw})$.

(c) Compare analog signal processing and digital signal processing. **04**

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

(b) Describe the phenomenon of aliasing. Discuss the remedies for the same. **07**

OR

(b) Explain the reconstruction of a band - limited signal from its samples. **07**

Q.3 **(a)** State and explain properties of ROC for Z-transform only. **06**

(b) Sketch the various tolerance limits to approximate the following filter :- **08**

(i) A low-pass filter (ii) A high-pass filter

(iii) A band-pass filter (iv) A band –stop filter.

OR

Q.3 **(a)** The system function of a causal linear time invariant system is **06**

$$H(z) = \frac{(1- z^{-1})}{(1 + 0.75\, z^{-1})}$$

The input to the system is $x(n) = (1/3)^n u(n) + u(-n-1)$.

(i) Find the impulse response to the system.

(ii) Find the output y (n).

(iii) Is the system stable?

(b) (i) Differentiate: Linear Convolutions and Circular Convolution. **08**

(ii) Explain the digital processing of analog signals.

Q.4 Design a Butter- worth filter with pass band magnitude within 0.99 dB for frequency $0 \leq w \leq 0.2\ \pi$ and stop band attenuation greater than 15 dB for frequency $0.3\ \pi \leq | w | \leq \pi$ using Bi-linear Transformation approach. **14**

OR

Q.4 Describe the Kaiser window filter design method for : **14**

(i) A high pass filter and

(ii) A low pass filter.

Q.5 **(a)** Using Hilbert Transform, find relationship between magnitude and phase. **06**

(b) Consider a causal system whose input and output satisfy the difference equation $y(n) - a\ y(n-1) = x(n)$. **08**

(i) Find H (z), ROC and condition(s) for stability.

(ii) Plot detailed pole-zero diagram.

(iii) Find impulse response.

(iv) Given system is IIR or FIR? Why?

OR

Q.5 **(a)** Discuss the parallel form structures for first order as well as for second order sections for an LTI system. **06**

(b) Obtain z-transform for **08**

(i) $x(n) = a^{n} u(n)$

(ii) $x(n) = -a^{n} u(-n-1)$.

Also, state ROC for each and plot pole-zero diagram.

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