(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3048 Roll No. | | | | | | | | | | |

## B.Tech.

EIGHTH SEMESTER EXAMINATION, 2004-2005

# DIGITAL SIGNAL PROCESSING

*Time : 3 Hours* *Total Marks : 100*

**Note :** *(i) Answer all the **FIVE** questions.*

*(ii) In case of numerical problems assume data wherever not provided.*



**1.** Attempt ***any four*** of the following : **5x4=20**

(a) What are the advantages of Digital Signal Processing over Analog Signal Processing ?

(b) What is the role of Analog-to-digital converter in a Digital Signal Processing System ?

(c) Consider the analogy signal

$xa(t) = 3\cos 2000\,\pi t + 5\sin 6000\,\pi t + 10\cos 12{,}000\,\pi t$

What is the discrete-time signal obtained after sampling the above continuous signal using a sampling rate $f_{(s)} = 5000$. Samples/second.

(d) The accumulator described by $y(n) = \sum_{k=-\infty}^{n} x(k)$, is excited by the sequence $x(n) = nu(n)$. Determine its output when accumulator is initially relaxed.

(e) What do you understand by a causal recursive system ? Give the general input-output equation for this type of system. How it is different from a causal non-recursive system ?

(f) What is an "Inverse System" ? Determine the inverse of the system with impulse response

$$h(n)=\left(\frac{1}{2}\right)^n u(n).$$

2. Attempt ***any four*** of the following : **5x4=20**

(a) State and explain the Paley-Wiener Theorem.

(b) Comment on the characteristics of the practical frequency selective filters.

(c) What do you understand by symmetric FIR filters ?

(d) What do you understand by "Rectangular Window" ? Why it is necessary to use windows in the design of FIR filters ?

(e) What do you understand by effect of finite-Register length in the FIR filter design ? Explain how this efect affects the filter performance ?

(f) What is the effect of coefficient quantization on the

(i) Phase characteristic and

(ii) Magnitude characteristic of the linear phase FIR filters ? Show that a high order filter should be reducid to a cascade realization to minimize the effect of quantization errors in the coefficients.

3. Attempt *any two* of the following : 10x2=20

(a) Explain the method of frequency transformation to design an IIR filter. What type of frequency selective filter are designed using this method ?

(b) Explain the bilinear transformation method to design an IIR filter from an analog prototype. Show that bilinear transformation maps the left-half s-plane inside the unit circle and maps the $j\Omega$ -axis in a one-to-one manner onto the unit circle.

(c) Define the Chekyshev filters in terms of the chekyshev polynomials. Give the recursive formula to generate the Chekyshev formula. Explain the difference between type I and type II Chekyshev filters.

4. Attempt *any two* of the following : 10x2=20

(a) What do you understand by "decimation factor" and "interpolation factor" in sampling-rate conversion, used in the field of multirate digital signal processing ?

(b) Differentiate among following nonparametric methods of power spectrum estimation.

(i) The Barlett Method

(ii) The Welch Method

(iii) The Blackman and Tukey method

(c) Briefly describe the following methods for the AR model parameters :

(i) The Yule-Walker Method, and

(ii) The Burg Method

5. Answer *any two* of the following : 10x2=20

(a) Why DSP hardware/algorithms are becoming popular in speech and radar signal processing ? Explain how DSP hardware/algorithm can improve speech processing.

(b) Briefly explain the working of following subsystems of a digital signal generators used in a radar system.

(i) Memory and recursive generator

(ii) Memory for table lookup

(iii) D/A converter (DAC)

(iv) Analog filter

(v) Mixer

How DSP can be applied in this digital signal generator ?

(c) (i) What is a "Chirp Signal" ? and why it is called so ?

(ii) What are clutter signals and how these can be alleviated ?

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