Printed Pages – 4 TEC – 602

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

PAPER ID : 3092 Roll No. | | | | | | | | | | |

B.Tech.

(SEM VI) EVEN SEMESTER THEORY EXAMINATION, 2009-2010

DIGITAL SIGNAL PROCESSING

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt **all** questions.*

*(ii) All questions carry **equal** marks.*

*(iii) Be precise in your answer. **No second** answer book will be provided.*

1. Attempt **any four** parts of the following : **(4x5=20)**

(a) Establish the relationship between sampled Fourier transform and the DFT.

(b) Compare DFT and FT.

(c) Find the response of an FIR filter with impulse response h(n) = {1, 2, 3} to the input sequence $x(n) = \{1, 2\}$.

(d) The first five points of the 8-point DFT of a real valued sequence are {0.25, 0.125-j0.3018, 0, 0.125-j0.0518, 0}. Determine the remaining three points.

(e) Give the statement and proof of the Periodicity and Symmetry properties of the DFT.

(f) Find the DFT of the sequence $X(n) = \{1, 0, 0, -4, 2\}$

2. Attempt **any four** parts of the following : **(4x5=20)**

(a) Define and explain any two of the following terms :

(i) Auto Correlation

(ii) Cross-Correlation and

(iii) Circular Correlation.

(b) Draw the stage wise flow graph for radix-2 decimation in time-FFT algorithm for $N = 4$.

(c) Write notes on any one of the following algorithms :

(i) Goertzel algorithm

(ii) Chirp-z Transform Algorithm.

(d) Find the bit reversed decimal equivalent of 2 & 5 for 8 point, 16 point FFT computations respectively.

(e) Calculate the DFT of a sequence $X(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT FFT.

(f) Discuss the computation efficiency of FFT over DFT.

3. Attempt **any four** parts of the following : **(4x5=20)**

(a) Obtain the Direct form-I structure for the system

$$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7X(n) - 0.252X(n-2)$$

(b) Obtain the ladder structure for $H_{(z)} = 1/(z^3 + 2z^{-2} + 2z^{-1} + 1)$.

(c) Obtain the cascade form realization for the transfer function of an FIR system given by $H_{(z)} = \{1 - (1/4)z^{-1} + (3/8)z^{-2}\}$ $\{1 - (1/8)z^{-1} - (1/2)z^{-2}\}$

(d) Determine the Transposed direct form II for the given system

$y(n) = 0.5\ y(n-1) - 0.25\ y(n-2) + X(n) + X(n-1).$

(e) Whether a system represented by its transfer function H(z) given by

$H\ (Z) = 4 + 3z/(z - 1/2) - \ 1/(z - 1/4),$

represent an FIR or an IIR filter ?

(g) Explain the parallel and cascade form realizations of IIR filters.

4. Attempt **any two** parts of the following : **(2x10=20)**

(a) What is an FIR system ? What are the advantages and disadvantages of FIR system ? Compare an FIR system with an IIR System.

(b) Design a linear phase FIR (low pass) filter of order seven with cutoff frequency of $\pi/4$ rad/ sec using Hanning window.

(c) Design a low pass FIR filter for the following specification :

Cutoff frequency	= 500Hz
Sampling frequency	= 200Hz
Order of the filter, N	= 10
Filter length, L = N + 1	= 11

Use Hamming window to get modified impulse response.

5. Attempt **any two** parts of the following : **(2x10=20)**

(a) (i) What is meant by frequency warping ? What is the cause of this effect ?

(ii) Compare the impulse invariance method with Bilinear Transform method of IIR filter design.

(b) Design a digital Butterworth filter that satisfies the following constraints, using

(i) Bilinear transformation and

(ii) impulse invariant transformation.

$$0.9 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq \pi/2$$

$$|H(e^{j\omega})| \leq 0.2 \qquad 3\pi/4 \leq \omega \leq \pi$$

(c) Design the second order low pass digital filter of Butterworth type using Bilinear Transformation for the specification given below :

(i) Analog transfer function of the filter :

$$H(s) = 1/[s^2 + (\sqrt{2})s + 1]$$

(ii) Cutoff frequency = 1 kHz

(iii) Sampling frequency = 10kHz

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