

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

PAPER ID : 3092

Roll No.

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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 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 : (2×10=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.

- (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.

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

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

- (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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