

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

PAPER ID : 0300

Roll No.

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**B.Tech.**(SEM. VII) ODD SEMESTER THEORY EXAMINATION  
2010-11**FUNDAMENTAL OF DIGITAL SIGNAL PROCESSING**

Time : 3 Hours

Total Marks : 100

Note : Attempt all questions.

1. Attempt any four parts of the following : (5×4=20)

- (a) Determine the response of the following system to the I/P signal :

$$x(n) = \begin{cases} |n| & -3 \leq n \leq 3 \\ 0 & \text{otherwise} \end{cases}$$

(i)  $y(n) = x(n-1)$

(ii)  $y(n) = x(n+1)$

- (b) For each of the following impulse response of LTI systems indicate whether or not the system is causal :

(i)  $h[n] = u(n+2) - u(n-2)$

(ii)  $(\frac{1}{2})^n u(n-1)$

- (c) For the following impulse response of LTI system indicate whether or not the system is stable :

$$h[n] = \sin(n\pi/3) u(n)$$

- (d) The given signal is periodic or not, if periodic calculate period :

$$x[n] = e^{j(2\pi n/5)}$$

- (e) Find the DFT of the sequence :

$$x(n) = 1 \text{ for } 0 \leq n \leq 2$$

$$= 0 \text{ otherwise}$$

- (f) State and explain "time reversal of a sequence" property of DFT.

2. Attempt any **four** of the following : (5×4=20)

- (a) State sampling theorem. Draw the spectrum of a sampled signal and explain aliasing.
- (b) Define all pass systems and minimum phase systems.
- (c) Explain the need for multirate signal processing.
- (d) Explain how sampling rate can be increased by an Integer factor.
- (e) Explain the use of oversampling to simplify the process of analog-to-digital conversion in brief.
- (f) With the help of block diagram explain Discrete time processing of continuous time signals.

3. Attempt any **two** of the following : (10×2=20)

(a) Obtain the cascaded realization for the following systems :

$$(i) \quad H(z) = \frac{(1 + \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}) (1 - \frac{3}{2}z^{-1} + z^{-2})}{(1 + z^{-1} + \frac{1}{4}z^{-2}) (1 + \frac{1}{4}z^{-1} + \frac{1}{2}z^{-2})}$$

$$(ii) \quad H(z) = \frac{(1 - \frac{1}{2}z^{-1}) (1 - \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2})}{(1 + \frac{1}{4}z^{-1}) (1 + z^{-1} + \frac{1}{2}z^{-2}) (1 - \frac{1}{4}z^{-1} + \frac{1}{2}z^{-2})}$$

(b) Develop Cascade and Parallel realisation structures for :

$$H(z) = \frac{z/6 + 5/24 + 5/24z^{-1} + 1/24z^{-2}}{1 - \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2}}$$

(c) What is the effect of roundoff noise in digital filters ?  
Analyse the direct form IIR structure.

4. Attempt any **two** of the following : (10×2=20)

(a) Explain the procedure for designing an FIR filter using Kaiser Window.

(b) Discuss the Bilinear transformation design techniques for IIR filters.

(c) A filter is to be designed with the following desired frequency response :

$$H_d(e^{j\omega}) = \begin{cases} 0 & -\pi/4 \leq \omega \leq \pi/4 \\ e^{-j2\omega} & \pi/4 < |\omega| \leq \pi \end{cases}$$

Determine the filter coefficients  $h_d(n)$  if the window function is defined as :

$$w(n) = \begin{cases} 1 & 0 \leq n \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

Also determine the freq response  $H(e^{j\omega})$  of the designed filter.

5. Attempt any **two** of the following :

**(10×2=20)**

- (a) Draw the flow graph of an 8 point DIF FFT algorithm and explain.
- (b) Define Goertzel algorithm.
- (c) Explain Fourier analysis of continuous time signals using DFT.