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SVKM's NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B.Tech (Computer) Year: III Semester: V

Academic Year: 2019-20

Subject: Digital Signal Processing

Date: 14 November 2019

Marks: 70
Time: 10.00 am - 1.00 pm
Durations: 3 (hrs)
No. of Pages: 02

Final Examination (2019-20)/ Re-Examination (2017-18/ 2018-19)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

1) Question No. 1 is compulsory.
2) Out of remaining questions, attempt any 4 questions.
3) **In all 5 questions to be attempted.**
4) All questions carry equal marks.
5) **Answer to each new question to be started on a fresh page.**
6) **Figures in brackets on the right hand side indicate full marks.**
7) **Assume suitable data if necessary.**

Q1. **a.** Consider the analog signal x(t)=3cos100 πt.Determine the minimum sampling rate to avoid aliasing. Suppose that the signal is sampled at the rate Fs=200Hz.What is the discrete time signal obtained after sampling? **[3]**

b. Determine if the system described by the following input output equations are causal or no causal **[4]**

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

y(n)=x(n)+3x(n+4)

c. What is FI-R filters? Compare its characteristics with an IIR filter. **[3]**

d. Give the steps to get result of linear convolution from circular convolution **[4]**

Q2. **a.** Determine the zero input response of the system described by the homogeneous second order difference equation $y(n) - y(n-1) - 4y(n-2) = 0$ **[7]**

b. Compute the linear convolution of the following signals **[7]**

x(n)={1,2,4} and h(n)={1,1,1,1,1}

Q3. **a.** Determine the parallel realization of IIR Filter [7]

$$H(z) = \frac{3(2z^2 + 5z + 4)}{(2z + 1)(z + 2)}$$

b. Obtain a cascade realization of the system characterized by the transfer function [7]

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{\left(\left(1+\frac{1}{2}z^{-1}\right)\right)\left(\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)\right.}$$

Q4. **a.** Determine the Z Transform of the following signal [7]

$x(n)=\cos w_0 n$ for $n>0$

b. A system has an input response $h(n)=\{1,2,3\}$ and output response $y(n)=\{1,1,2,-1,3\}$ [7]
Determine the input sequence x(n).

Q5. **a.** Find the 4-point DFT of $x(n) = sin\left[\frac{n\pi}{2}\right]$ [7]

b. State and prove circular time shift property of Fourier Transform [7]

Q6. **a.** A low pass filter is to be designed with the following desired frequency response [7]

$$Hd\left(e^{-j2w}\right) = e^{-j2w} \qquad -\frac{\pi}{4} \le w \le \frac{\pi}{4}$$

$$=0 \qquad \frac{\pi}{4} \le w \le \pi$$

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

$$w(n) = 1 \qquad for\ 0 \le n \le 4$$

$=0$ otherwise

b. Explain frequency sampling method of designing FIR filter [7]

Q7 **a.** Compute 4-point IDFT of $X(k) = \{6, -2 + 2j, -2, -2 - j2\}$ using DIT-FFT algorithm [4]

b. Compare DIT-FFT & DIF-FFT on any four points [4]

c. Draw the flow graph of an 8 point DIF-FFT algorithm [3]

d. Determine the Cross correlation of the sequences [3]

$x_1(n)=[1,2,3,4]$ & $x_2(n)=[4,3,2,1]$