Q. P. Code: 27083

[Time: Three Hours] **[Marks:80]**

N.B.: (1) Question No.1 is compulsory.
(2) Attempt any three out of remaining questions.
(3) Assume suitable data wherever required.

Q.1 a. State Parseval's relation in z-transform. (05)

b. Assume two finite duration sequences $x_1(n)$ and $x_2(n)$ are linearly combined. Let $x_3(n) = ax_1(n) + bx_2(n)$. What is the DFT of $x_3(n)$? (05)

c. What is the need for employing window technique for FIR filter design? (05)

d. What is the need for anti–aliasing filter prior to downsampling? (05)

Q.2.a. Design an FIR filter approximating the ideal frequency response (10)

$$H_d(e^{jw}) = e^{-j3w} \quad \text{for } \frac{-\pi}{4} \ |\omega| \le \frac{\pi}{4}$$

$$= 0 \quad \text{for } \frac{\pi}{4} \le |\omega| \le \pi$$

Using Hamming window with N= 7.

b. Derive the DFT of the sample data sequence x(n)={ 1,1,2,2,3,3}and compute the corresponding amplitude and phase spectrum. (10)

Q.3.a. Determine 8 point DFT for a continuous time signal, $x(t)$ = sin(2nFt) with $F = 50Hz$ using DIF FFT algorithm. (10)

b. Design a Butterworth filter using the impulse variance method for the following specifications (10)

$$0.9 \le |H(e^{jw})| \le 1 \qquad 0 \le \omega \le 0.3\pi$$

$$|H(e^{jw})| \le 0.1 \qquad 0.7\pi \le \omega \le \pi$$

Q.4.a. Determine the Direct form-I and Direct form-II realization for the system y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2). (10)

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b. A multirate system is shown below in Fig.1. Find the relation between x(n) and y(n) . (10)

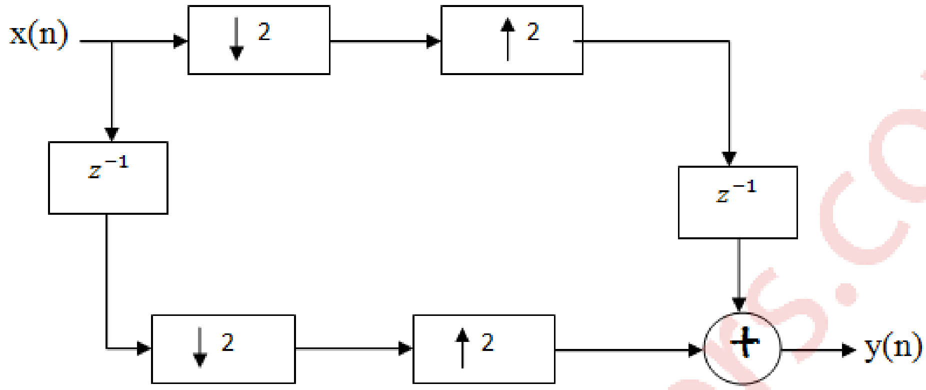

Fig.1

Q.5 a. Determine the periodogram of the random signal by taking 8 samples of the signal (10)

$x(n)\ \cos 2\pi f_1 n + \cos 2\pi (f_1 + \Delta f)n$, $f_1 = 0.2$, $\Delta f = 0.05$.

b. The transfer function $H(z) = H_1(z)H_2(z)$ where (10)

$$H_1(z) = \frac{1}{1-a_1 z^{-1}} \text{ and } H_2(z) = \frac{1}{1-a_2 z^{-1}}$$

Assume $a_1 = 0.5$ and $a_2 = 0.6$, find the output roundoff noise power. (10)

Q.6.Write short notes on following,

a. Musical Sound Processing. (07)

b. Dual tone multi frequency signal detection. (06)

c. Subband Coding of Speech signals. (07)

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