BE | VII EXTC (old) DTSP

Q.P. Code : 628302

(3 Hours) **[Total Marks : 100**

N.B. : - i) Question No. 1 is **compulsory**.
ii) Answer any **four** questions out of remaining **six** questions.
iii) Figure to the **right** indicates **full marks**.
iv) **Illustrate** the answers with **sketches** wherever **required**.

1 (a) What is the relation between DFT and DTFT? [20]
(b) What are the advantages and disadvantages of FIR filter and IIR filter?
(c) State and prove circular time shift and circular frequency shift property of DFT.
(d) What is the need of multirate signal processing?
(e) Compare various windows for design of FIR filters.

2 (a) Given
X[k]={36, -4+j9.656, -4+j4, -4+j1.656, -4, -4-j1.656, -4-j4, -4-j9.656}
using IFFT algorithm calculate x(n). [10]
(b) By means of DFT and IDFT technique compute the circular convolution of the following sequences
$x_1(n) = \{1,2,3,4\}$ *and* $x_2(n) = \{5,6,7,8\}$

3 (a) Show Direct Form-I, Direct Form-II realization. [10]

$$H(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 - z^{-1} + \frac{3}{16}z^{-2}}$$

(b) An all pole IIR filter has transfer function [10]

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

Obtain the lattice coefficients and show lattice realization.

4 (a) Design low pass filter for following specification [10]

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega}, & -\frac{\pi}{4} \le \omega \le \frac{\pi}{4} \\ 0, & \frac{\pi}{4} < \omega \le \pi \end{cases}$$

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

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

(b) i) Explain Polyphase decomposition process. [10]
ii) Write a short on Adaptive television echo cancellation.

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5 (a) What are the effects of finite word length in digital filter. [08]

(b) A low pass filter has following specifications [12]

$$0.8 \leq |H(e^{j\omega})| \leq 1 \quad \text{for } 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.2 \quad \text{for } 0.6\pi \leq \omega \leq \pi$$

Find the filter order and analog cutoff frequency using Impulse Invariance technique.

6 (a) Determine the response of the system with impulse response [10]

$$h[n] = \left(\frac{1}{2}\right)^n u[n]$$

when the input is

$$x[n] = 10 - 5\sin\frac{\pi}{2}n + 20\cos\pi n \qquad -\infty < n < \infty$$

(b) Convert the analog filter with system function [10]

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$

into a digital IIR filter using Bilinear transformation. The digital filter should have a resonant frequency of $\omega_r = \frac{\pi}{4}$

7 (a) $x(n) = \{1 + 5j, 2 + 6j, 3 + 7j, 4 + 8j\}$, Find DFT X(k). [10]

Using the result obtained above find the DFT of the following

sequence $x_1(n) = \{1, 2, 3, 4\}, x_2(n) = \{5, 6, 7, 8\}$

(b) Draw and explain the block diagram of a multistage decimator and integrator. [10]