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

PAPER ID : 2488 **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. VI) EVEN THEORY EXAMINATION 2012-13

DIGITAL SIGNAL PROCESSING

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions. All questions carry equal marks. Assume missing data suitably if any.

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

(a) Discuss the importance of realization of digital system. Find the system function of the system shown in following figure 1.

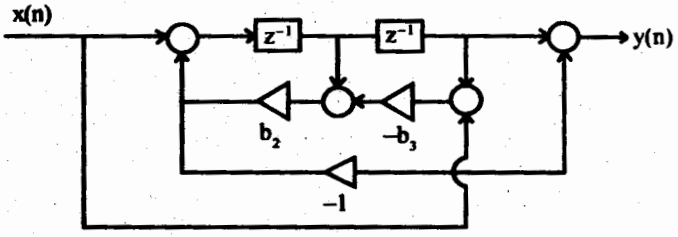

Figure 1

(b) Discuss the advantages of ladder form of realization. Find the ladder form of realization of the system function given by :

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

(c) Give two different realizations of the system described by system function :

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

and compare them.

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

(a) Compare FIR and IIR filters. For the analog transfer function given below :

$$Ha(s) = \frac{2s^2 + 3s + 3}{(s+1)(s^2 + 2s + 2)}$$

apply impulse invariant technique to find out the corresponding system function of digital filter with sampling rate 1s and 0.1s.

(b) Design Butterworth Low Pass filter using bilinear transformation; the frequency characteristics are given below :

$$0.85 \le |H(e^{j\omega})| \le 1 \qquad 0 \le \omega \le 0.2\pi$$

$$|H(e^{j\omega})| \le 0.5 \quad 0.6 \le \omega \le \pi$$

(c) Compare the characteristics of Butterworth and Chebyshev filter. Determine the parameters of a Chebyshev filter for which $A_1 = 1/2^{1/2}$, $A_2 = 0.1$, $\Omega_1 = 2$ rad/s and $\Omega_2 = 4$ rad/s.

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

(a) Shown that a FIR filter will have linear phase if its unit sample response satisfies $h(n) = \pm h(N-1-n)$.

(b) What are different methods for design of FIR Filter ? Explain Gibb's phenomenon with mathematical expression.

(c) Show that for a low pass linear phase FIR Filter :

$$hd(n) = \frac{\sin\omega_c(n-\tau)}{\pi(n-\tau)} \; ; n \neq \tau$$

$$= \omega_c/\pi \qquad n = \tau$$

and $\tau = \frac{N-1}{2}$.

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

(a) Show that :

$$IDFT\{\tilde{x}(k\cdot m)\} = W_N^{-mn} \; DFT\{\tilde{x}(x)\}$$

(b) Find linear convolution of sequences :

$$x_1(n) = \begin{cases} 1 & 0 \le n \le 2 \\ 0 & \text{otherwise} \end{cases}$$

$$x_2(n) = \begin{cases} 2^{-n} & 0 \le n \le 3 \\ 0 & \text{otherwise} \end{cases}$$

(c) Show that :

$$DFT\left\{\sum_{m=0}^{N-1} x(m)y(m-n)\right\} = X(k) * Y(k)$$

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

(a) What do you mean by FFT ? Explain DIT and DIF. Deduce the equation for DIT algorithm for N = 4 and draw the signal flow graph.

(b) Show that the output data is in bit reversed order for decimation in frequency algorithm for N = 8.

(c) Develop a DIT FFT algorithm using 4 part DFTs for $N = 4^r$.