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

(a) What do you mean by FFT ? Differentiate between DIT and DIF FFT algorithm. State and prove the symmetry and periodicity properties of complex exponential sequence W_M^K. Explain how these properties are used in FFT algorithms.

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

(c) Develop a DIT FFT algorithm using 4 point DFTs for the case $N = 4^v$. Compare the number of multiplications with the algorithm using 2-point PFTS with $N = 2^{2v}$.

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

PAPER ID : 2488 **Roll No.**

B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

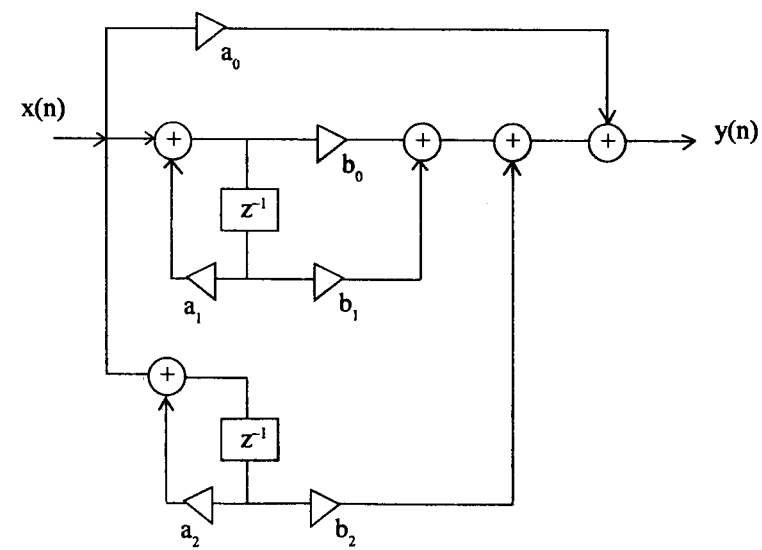
DIGITAL SIGNAL PROCESSING

Time : 3 Hours *Total Marks : 100*

Note : Attempt ***all*** questions. All questions carry equal marks.

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

(a) What do you mean by canonical form of realization ? Determine the system function $H(z)=\frac{Y(z)}{X(z)}$ for the following system shown in figure 1 :



(b) Find the ladder structure realization of the system function :

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

(c) System function $H(z)=\frac{Y(z)}{X(z)}$ for a linear shift invariant system is given by $\frac{2}{z^{-3}+4z^{-2}+z^{-1}+2}$.

Find the two part realization of the system.

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

(a) Explain frequency working effect. How this problem is overcome in Bilinear transform method of IIR filter design ?

Apply Bilinear transformation technique to transform the analog transfer function :

$$H_a(s)=\frac{1}{(s+1)(s^2+s+1)}.$$

(b) Design digital Butterworth filter from the specification given below :

$$0.8\le|H(e^{jw})|\le 1 \quad 0\le w\le 0.2\pi$$
$$|H(e^{jw})|\le 0.2 \quad 0.6\le w\le \pi$$

(c) Derive the mathematical expression for impulse invariance technique. Discuss its disadvantages and how it can be taken care of.

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

(a) Compare FIR and IIR filter. Show that for a linear phase FIR filter, the impulse response is given by :

$h(n) = h(N-1-n)$

or $h(n) = -h(N-1-n)$

and hence classify the FIR filters.

(b) Explain Gibb's phenomenon. Find the response of rectangular window and explain it.

(c) Determine the frequency response of symmetric Hann window given by :

$$w(n)=\begin{cases}\frac{1}{2}\left(1+\cos\frac{n\pi}{M}\right) & -m\le n\le M\\ 0 & \text{otherwise.}\end{cases}$$

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

(a) Find circular convolution of sequences $\tilde{x}_1(n)$ and $\tilde{x}_2(n)$ of length N = 4 given by :

$\tilde{x}_1(0)=1 \quad \tilde{x}_1(1)=2 \quad \tilde{x}_1(2)=2 \quad \tilde{x}_1(3)=1$

$\tilde{x}_2(0)=2 \quad \tilde{x}_2(1)=1 \quad x_2(2)=1 \quad x_2(3)=2$

(b) Compute the DFT of sequence $b^n \cos an$ and show that the IDFT of :

$$\{\tilde{x}(k-m)\} = W_N^{mn}\ \text{DFT}\{\tilde{x}(k)\}.$$

(c) Consider the sequences given by :

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

$$x_2(n)=\begin{cases}1 & 0\le n\le 2\\ 0 & \text{otherwise}\end{cases}$$

Compute the linear convolution of $x_1(n)$ and $x_2(n)$ using DFT.