

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

- 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.
- Show that the output data is in bit reversed order for the decimation-in frequency algorithm for $N = 8$.
- 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 $N = 2^{2v}$.

Printed Pages—4

EEEC602

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

PAPER ID : 2488

Roll No.

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B. Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

DIGITAL SIGNAL PROCESSING

Time : 3 Hours

Total Marks : 100

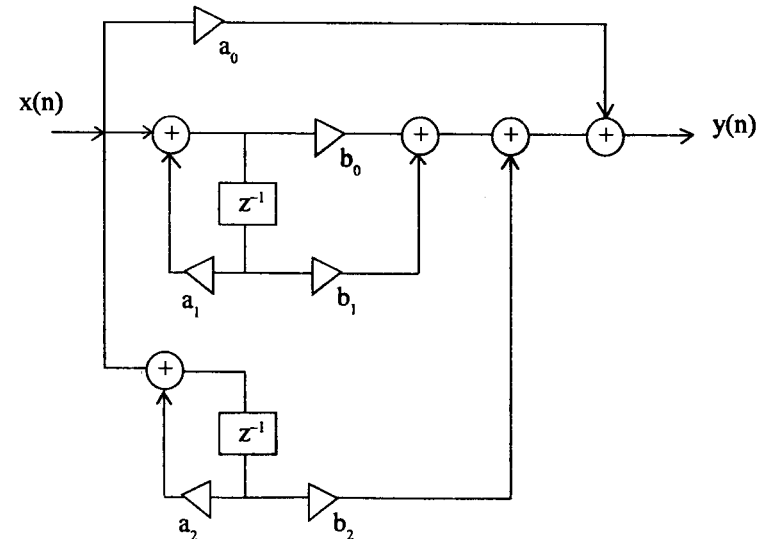
Note : Attempt *all* questions. All questions carry equal marks.

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

- 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

$$\text{system is given by } \frac{2}{z^{-3} + 4z^{-2} + z^{-1} + 2}$$

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 :

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

$$|H(e^{jw})| \leq 0.2 \quad 0.6 \leq w \leq \pi$$

- (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 :

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

$$\text{or } h(n) = -h(N-1-n)$$

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 :

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

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 :

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

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

- (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 :

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

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

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