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EEC602

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

PAPER ID : 131602

Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

DIGITAL SIGNAL PROCESSING

Time : **3**Hours] [Total Marks : **100**

1 Attempt **any four** parts **5×4=20**

(a) Draw the block diagram for the following system with input x(n) and output y(n)

$$w(n) = x(n) + \frac{1}{2}x(n-1) \text{ and}$$

$$y(n) + \frac{1}{4}y(n-1) = w(n)$$

(b) Obtain the cascade realization for the following system;

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

(c) Calculate the DFT of the sequence s(n)={2,4,2,3}.

(d) State and prove circular convolution property of DFT.

(e) Explain frequency transformation with LPF to HPF conversion formula.

(f) Draw a transformation matrix of size 5×5 and explain the properties of twiddle factor.

2 Attempt **any four** parts **5×4=20**

(a) Determine H(z) using the impulse invariant technique for the analog system function

$$H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$$

(b) Realise an FIR filter whose impulse response is h(n)={1, 2, 5, 6, 3, 6, 5, 2, 1} using minimum number of multipliers.

(c) Determine the response of a discrete-time system for an input signal s(n)={2,1, 3,1 }, if the unit-sample response is of the system is h(n)={1, 2,2,–1}

(d) Enumerate and explain the properties of DFT.

(e) Draw the parallel form network structure of the system with transfer function.

$$H(z) = \frac{2z(z+3)}{z^2+0.3z+0.02}$$

(f) What are the different window functions used for windowing ? Explain the effects of using different window functions for designing FIR filter on the filter response.

3 Attempt **any two** parts **10×2=20**

(a) Derive and draw the flow graph for DIF FFT algorithm for N=8.

(b) Calculate the circular convolution of $s_1(n)$ = {1,2,1,2} and $s_2(n)$={1, 2, 3, 4} using Stockham's method.

(c) Determine H(z) for a butterworth filter satisfying the following constraints

$$\sqrt{0.5} \leq \begin{array}{ll} |H(e^{j\omega})| \leq 1 & 0 \leq \omega \leq \frac{\pi}{2} \\ |H(e^{j\omega})| \leq 0.2 & \frac{3\pi}{4} \leq \omega \leq \pi \end{array}$$

with T=1 sec. Apply impulse invariant transformation

4 Attempt **any two** parts; 10×2=20

(a) Given x(n) $=2^n$ and N=8 find X(K) using DIT FFT algorithm. Also calculate the computational reduction factor.

(b) Design a low-pass filter with the following desired frequency response

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

and using window function

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

(c) Draw the Ladder structure for the system with system function

$$H(z) = \frac{5z^{-3} + 2z^{-2} + 3z^{-1} + 1}{z^{-3} + z^{-2} + z^{-1} + 1}$$

5 Attempt **any two** parts : **10×2=20**

(a) Design a digital chebyshev filter to satisfy the constraints

$$0.77 \leq \ |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.1 \qquad 0.5\pi \leq \omega \leq \pi$$

Using bilinear transformation with T=1s

(b) Convert the analog filter with system function $H(s) = \frac{s+0.1}{(s+0.1)^2+9}$ into digital filter with a resonant frequency of $\omega_r = \frac{\pi}{4}$ of using bilinear transformation.

(c) Explain the following phenomenon's :

(i) Gibbs Oscillations.

(ii) Frequency Wraping.