Exam.Code:0969
Sub. Code: 7042

2123

M.E. (Electronics and Communication Engineering)
First Semester
ECE-1101: Advanced Digital Signal Processing
(For UIET only)

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: *Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*

x-x-x

1. (a) Perform Circular Convolution on sequences $x_1(n) = \{2,3,6,-8\}$ and $x_2(n) = \{1,2,3\}$.

   (b) Describe muiti-resolution analysis of signals with the help of wavelet transform.

   (c) Determine all the FIR filters which are specified by the lattice parameters, $K_1 = 0.6$, $K_2 = 0.4$, $K_3 = 0.25$.

   (d) Briefly discuss process of active noise control using adaptive filters.

   (e) Compare the design considerations for FIR and IIR filters.

   (5×2=10)

Section-A

2. (a) Compare the computational complexity of DFT and FFT. Describe the Divide and Conquer approach for calculation of DFT. Discuss radix-2 decimation in frequency FFT algorithm with the help of butterfly diagram. (5)

   (b) A LPF is to be designed with the following desired response (5)

$$H_d(\omega) = \begin{cases} e^{-j4\omega} & 0 \le \omega \le \frac{\pi}{2} \\ 0 & \frac{\pi}{2} \le \omega \le \pi \end{cases}$$

   Determine the filter coefficients h(n) for M=9 using frequency sampling technique.

3. (a) Design a digital Chebyshev filter to satisfy the criterion (7)

$$0.83 \le H(\omega) \le 1, \qquad 0 \le \omega \le 0.3\pi$$
$$H(\omega) \le 0.23, \qquad 0.57\pi \le \omega \le \pi$$

   Using impulse invariant transformation.

   (b) Obtain the 2-band polyphase decomposition of IIR function: (3)

$$H(z) = \frac{1 + 0.3z^{-1}}{1 - 0.8z^{-1}}$$

P.T.O.

4. (a) Derive expression for frequency domain representation of decimation process. (4)

(b) A low-pass filter is to be designed to pass a signal with a bandwidth of 40 Hz and reject everything above 50 Hz, with an attenuation of at least 50 dB. The sampling frequency is 8 KHz. (6)

a. Determine the order of the filter using FIR window method.

b. Design a multistage low-pass filter for decimation in three stages to achieve efficient representation. Choose appropriate decimation factors and find the number of operations per second.

Section-B

5. (a) Describe forward linear prediction filter with the help of equations and lattice structure. (5)

(b) Describe concept of adaptive filter explaining one configuration of adaptive filter in detail. (5)

6. (a) Describe LMS adaptive algorithm and discuss its practical limitations. (6)

(b) Determine the lattice coefficients for the FIR filter with the system function (4)

$$H(z) = 1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}$$

7. (a) Describe TMS320C6X processor and explain memory and interrupt structure. (5)

(b) Describe fixed point and floating point representation of numbers. Explain Arithmetic operations on floating point numbers. (5)

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