Exam.Code:0969
Sub. Code: 34521

2124

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 five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

1. (a) Find the inverse Z-transform of a stable system

$$H(z) = \frac{z^{-1}}{\left(z - \frac{1}{2}\right)\left(1 + \frac{1}{2}z^{-1}\right)}$$

(b) Discuss finite word-length effects in digital filters.

(c)Perform the polyphase decomposition of IIR filter:

$$H(z) = \left(\frac{1 + 0.7z^{-1}}{1 - 0.9z^{-1}}\right)$$

(d)Differentiate fixed-point and floating-point processors.

(e) Describe Wiener filter. (5×2)

Section-A

2. (a)Find whether the following systems are Memoryless, Time- Invariant, Linear, Causal, and Stable. Justify your answer. (5)

   i. $y[n] = \log_{10}(|x[n]|)$

   ii. $y[n] = \sum_{k=-\infty}^{n} x[k+2]$

   (b) Describe Forward and Inverse Discrete Cosine Transform. How can it be used as an orthogonal transform? (5)

3. (a)Design a digital Butterworth filter to satisfy the criterion (6)

$$0.821 \le H(\omega) \le 1, \qquad 0 \le \omega \le 0.27\pi$$
$$H(\omega) \le 0.202, \qquad 0.5\pi \le \omega \le \pi$$

Using impulse invariant transformation.

(b)Obtain the direct-form, cascade and parallel structure of system (4)

$$H(z) = \left(\frac{1 + 0.4z^{-1}}{1 - 0.7z^{-1}}\right)\left(\frac{1 + 3z^{-1} + z^{-2}}{1 - 2.3z^{-1} + 0.78z^{-2}}\right)$$

P.T.O.

4. (a)A low-pass filter is to be designed to pass a signal with a bandwidth of 35 Hz and reject everything above 45 Hz, with an attenuation of at least 55 dB. The sampling frequency is 8 KHz. (5)

   i) Determine the order of the filter using FIR window method.
   ii) Design a multistage low-pass filter in three stages to achieve efficient representation. Choose appropriate decimation factors and find the number of operations per second

   (b)Describe use of discrete wavelet transform in Multirate signal processing. (5)

Section-B

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

   (b)Discuss application of adaptive filter in Active Noise Control. (5)

6. (a)Describe the concept of Adaptive Filter and discuss any one application in detail. Describe LMS adaptive algorithm and discuss its practical limitations. (6)

   (b)Determine all FIR filters which are specified by the lattice parameters, $K_1 = 0.52$, $K_2 = 0.33$, $K_3 = 0.25$. (4)

7. (a) Describe architecture of TMS320C6X processor and discuss memory management and addressing modes. (5)

   (b) Describe ARMA lattice-ladder filters for filtering and prediction. (5)

x-x-x