Exam.Code:0969
Sub. Code: 7042

2023

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) Determine the impulse response of the system

$$y[n] = 0.6y[n-1] - 0.08y[n-2] + x[n]$$

(b) Describe sub-band coding.

(c) Obtain the cascade and parallel form structure of system

$$H(z) = \frac{(3+5z^{-1})(0.6+3z^{-1})}{(1-2z^{-1}+2z^{-2})(1-z^{-1})}$$

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

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

(e) Describe the application of Adaptive filter in echo cancellation.

(5×2=10)

Section-A

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

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

   ii. $y[n] = x(n^2)$

   (b) Describe Divide and Conquer approach for calculation of DFT. Compare computational requirements of DFT and FFT. (5)

3. (a) When the input to a LTI system is (6)

$$x(n) = \left(\frac{1}{2}\right)^n u(n) + (2)^n u(-n-1)$$

the output is

$$y(n) = 6\left(\frac{1}{2}\right)^n u(n) - 6\left(\frac{3}{4}\right)^n u(n)$$

Contd.....P/2

i. Find the system function H(z) of the system. Plot the poles and zeros of H(z), and indicate the region of convergence.

ii. Find the impulse response h(n) of the system for all values of n.

iii. Is the system stable? Is it causal?

(b) A LPF is to be designed with the following desired response (4)

$$H_d(\omega) = \begin{cases} e^{-j3\omega} & 0 \le \omega \le \frac{\pi}{2} \\ 0 & \frac{\pi}{2} \le \omega \le \pi \end{cases}$$

Determine the filter coefficients using window method for achieving an attenuation of 45 dB.

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

$$0.88 \le H(\omega) \le 1, \qquad 0 \le \omega \le 0.24\pi$$
$$H(\omega) \le 0.21, \qquad 0.51\pi \le \omega \le \pi$$

Using impulse invariant transformation. (6)

(b) Describe the polyphase decomposition of QMF banks. Find the condition for perfect reconstruction (4)

Section-B

5. (a) Describe forward linear prediction filter with the help of equations and lattice structure. (6)

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

$$H(z) = A_3(z) = 1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}$$

6. (a) Describe the concept of Adaptive Filter and describe any one application in detail. Describe LMS adaptive algorithm and discuss its practical limitations. (5)

(b) Describe the concept of Active noise control using Adaptive filters. (5)

7. (a) Describe architecture of TMS 320 C6x series and explain the addressing modes and interrupt structure. (7)

(b) Differentiate fixed point and floating point processors (3)

x-x-x