Exam.Code:0937
Sub. Code: 6993

2021
B.E. (Electrical and Electronics Engineering)
Seventh Semester
EE-708: Digital Signal Processing

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 Unit.*

x-x-x

Q1i). Find the step response of the system whose impulse response is $h(n) = (\frac{1}{3})^n$

ii)How an aperture effect distortion is reduced in flat top sampling?

iii) Find the cross correlation of two finite length sequence x(n)={1,2,1,1} and y(n)={1,1,2,1}

iv). A LTI system has the following impulse response $h(n) = (\frac{1}{2})^n u(n+1)$ Is the system causal and BIBO stable?

v) Find the discrete fourier series coefficent for $x(n) = sin^2(\frac{\pi}{6}n)$

vi)Calculate the percentage saving in calculations in a 512 point radix 2 FFT when compared to DFT?

vii) If $X(z) = \frac{z}{z^2+2}$. Find z transform of (n-2)x(n-1)

viii) Why impulse invariant method is not preferred in the design of IIR filters other than low pass filter?

ix) Is the filter with h(n)={-1,0,1} is a linear phase filter?

x) What are the different buses of TMS320C5x?

(10x1)

UNIT – I

Q2. a) An LTI system is characterized by its impulse response $h(n)=(1/2)^n u(n)$. What is the spectrum of the output signal when the system is excited by the signal $x(n)=(1/4)^n u(n)$?

(5 Marks)

b) A signal $x(t) = sinc(150\pi t)$ is sampled at a rate of i) 100Hz, ii) 200Hz and iii) 300 Hz. For each of these three cases can you recover the signal x(t) from the sampled signal?

(5 Marks)

P.T.O.

Q3 a) Perform the circular convolution of the following sequences

$x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$ using DFT and IDFT method

(5 Marks)

b) Consider the following system function

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

For different possible ROCs,

i)ROC: $|z| > \frac{1}{2}$, ii) ROC: $|z| < \frac{1}{4}$ and iii) ROC: ROC: $\frac{1}{4} < |z| < \frac{1}{2}$

Determine the causality, stability and the impulse response of the system (5 Marks)

Q4. a) $y(n) + 5y(n-1) + 6y(n-2) = x(n-1) + 2x(n)$ with input $x(n) = u(n)$. The initial conditions are y(-1)=1 and y(-2)=0. Find i) zero input response ii)zero state response and iii)total response

(5 Marks)

b) Compute 16 point DFTs of the following sequence

$x(n)=\cos(\frac{n\pi}{2})$,$0 \le n \le 15$ using radix 2 DIT FFT algorithm

(5 Marks)

UNIT – II

Q5 a) Obtain the Direct form I, Direct form II , cascade and parallel realization of LTI system governed by the equation

$$y(n) = -\frac{3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$$

(4 Marks)

b) Design a Butterworth digital low pass filter to meet the following specifications

$$0.9 \leq |H(w)| \leq 1;\ 0 \leq w \leq \frac{\pi}{2}$$

$$|H(w)| \leq 0.2 \quad ;\ \frac{3\pi}{4} \leq w \leq \pi$$

Use bilinear transformation mapping technique.Assume T=1 sec. (6 Marks)

Q6 a) Determine the frequency response of FIR filter defined by

$y(n) = 0.25x(n) + x(n-1) + 0.25x(n-2)$.Calculate the phase dealy and group delay?

(5 Marks)

b) Design a high pass FIR filter for the following specifications

Cut off frequency= 500Hz, Sampling frequency= 2000Hz, Order of filter=10 (5 Marks)

Q7 a) The desired response of a Low Pass Filter is

$$H_d(w) = e^{-j3w} \qquad 0 \leq w \leq \frac{\pi}{2}$$

$$= 0 \qquad \frac{\pi}{2} \leq w \leq \pi$$

Determine filter coefficents h(n) for N=7 using frequency sampling method (5 Marks)

b) Explain how Harvard architecture as used by the TMS320 family differs from the strict Harvard architecture? Compare this architecture with the architecture of Von-Neumann processor? (5 Marks)

x-x-x