Exam.Code:0937
Sub. Code: 6772

2074
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 Part.***

x-x-x

Q1a) What is the response of LTI system with impulse response $h(n) = \delta(n) + 2\delta(n-1)$ for the input x(n)={1,2,3}?

b) Find the Z transform of $x(n) = a^n \sin(nwT) \quad for\ n \geq 0$

c) Find the IDTFT of a sequence

$$X(w) = \begin{cases} j & 0 < w \leq \pi \\ -j & -\pi < w \leq 0 \end{cases}$$

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

e) Determine the order of low pass Butterworth analog filter that has a 3dB attenuation at 500 Hz and an attenuation of 40 dB at 1000 Hz?

(2x5=10 Marks)

PART A

Q2a) The analog signal be represented as $x(t) = sin(10\pi t) + 2sin(20\pi t) - 2\cos(30\pi t)$ is sampled with sampling frequency of 20 Hz. What is the discrete time signal obtained after sampling? What is the recovered signal?

(5 Marks)

b) Prove that the multiplication of the DFT's of two sequences is equivalent to the DFT of the circular convolution of the two sequences in time domain. **(5 Marks)**

Q 3a) Determine the inverse z transform of the following:

i) $X(z) = \log(1 - 2z), |z| < \frac{1}{2}$ ii) $X(z) = \frac{z^{-1}(1+z^{-1})}{(1-z^{-1})^3}, |z| > 1$ **(5 Marks)**

b) Compute the DFT of the sequence

$$x(n) = \cos\left(\frac{n\pi}{4}\right) for\ 0 \leq n \leq 7$$

Using radix 2 DIF FFT algorithm. Draw the butterfly diagram also? **(5 Marks)**

P.T.O.

Q 4 a) Consider the following difference equation

y(n)+2y(n-1) + 2y(n-2) = x(n) where x(n)= u(n). The initial conditions are y(-1)=0 and y(-2)=2.Find i) Zero state response ii) Zero input response iii) Total response **(5 Marks)**

b) Develop a radix 2 DIT FFT algorithm for decomposing the DFT for N=6 and draw the flow diagrams for (i) N=2.3 and (ii) N=3.2 **(5 Marks)**

PART B

Q5 a) Design an FIR high pass digital filter using hamming window method for the following specifications:

Cut off frequency is 500 Hz , Sampling frequency is 2000Hz and Order of filter is 10?

(5 Marks)

b) For the given specification design a digital Chebyshev filter

$0.8 \leq |H(j\Omega)| \leq 1 \ for \ 0 \leq \Omega \leq 0.2\pi$

$|H(j\Omega)| \leq 0.2 \ for \ 0.32\pi \leq \Omega \leq \pi$ Using bilinear transformation method. Assume T=1 seconds

(5 Marks)

Q6 a) Design an FIR low pass filter using fourier series method for the following specifications:

Cut off frequency is 1000 Hz , Sampling frequency is 10000Hz and Order of filter is 8?

(5 Marks)

b) Illustrate the steps involved in the design of linear phase FIR filter by frequency sampling method?

(5 Marks)

Q7 a) Explain how Harvard architecture as used by TMS320 family differs from the strict Harvard architecture. Compare this with the architecture of Von-Neumann processor? **(5 Marks)**

b) Obtain the direct form I, direct form II, cascade and parallel realization of system given by

$$y(n) + y(n-1) + 4y(n-3) - 2y(n-3) = x(n) - 2x(n-3)$$

(5 Marks)

x-x-x