Exam.Code:0937
Sub. Code: 33786

2076

B.E. (Electrical and Electronics Engineering)

Seventh Semester

PE-EE-703: 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

I. Attempt the following:-

a) What are twiddle factors, and how do they help reduce computational redundancy in FFT? Find the number of stages and number of butterflies per stage in a 64-point radix-2 FFT.

b) What is the role of the accumulator in TMS320C5x architecture? Mention any two features of the TMS320C5x DSP family?

c) Analyse why all-pass filters are used to correct phase distortion without altering amplitude response.

d) Using circular time-shift property: x(n)={1,2,3,4},X(k)={10,−2+2j,−2,−2−2j}.Find the DFT of y(n)=x((n−1)mod 4)

e) Given: x(n)={1,2,3}, y(n)={2,1,0}. Find Normalized cross-correlation at lag 0. (5x2)

UNIT - I

II. a) Find the inverse z transform of

$X(z) = \frac{z^{-1}}{(1-0.5z^{-1})^3}$ for ROC |z|>0.5 using partial fraction method?

b) Using radix-2 DIT FFT, compute the DFT of

x(n)={1+j, 2j, 3−j, 4, 1−j, −2j, 3+j, −1} (2x5)

III. a) Compute the linear convolution using DFT and zero padding.

x(n)={1,2,1} and h(n)={1,1}

b) Determine whether this system is linear, causal, time-invariant and stable:

$y[n]=x[n]-x^2[n-1]$ (2x5)

P.T.O.

IV. a) Consider the following difference equation

$y[n] - y[n-1] = x[n]$ Where $x(n) = \cos(\frac{n\pi}{3})$.The system is initially relaxed. Find the i) homogenous solution , ii) particular solution and iii) total solution

b) Find the circular convolution of the following using DFT-IDFT method. Given two periodic sequences of period 6

$$x(n) = cos(\frac{n\pi}{3})$$

$$h(n) = sin(\frac{n\pi}{6})$$

(2x5)

UNIT - II

V. a) Design a practical digital low pass filter using frequency sampling method for the following specification: Frequency of pass band edge=300 Hz, Frequency from which stopband begins=600Hz, Sampling frequency=2000 Hz, Filter length =11?

b) Convert the analog filter transfer function

$$H_a(s) = \frac{5}{s^2 + 12s + 15}$$

Into digital filter transfer function using bilinear transformation with T=1 seconds.

(6,4)

VI. a) Design a digital Butterworth low pass filter satisfying the following specifications:

$|H(\omega)| \geq 0.80 \leq \omega \leq 0.4\pi$

$|H(\omega)| \leq 0.250.7\pi \leq \omega \leq \pi$

With T=0.5 seconds using impulse invariant transformation method

b) The transfer function of the system is given by

$$H(z) = \frac{2z^{-1}+3}{1-0.6z^{-1}+0.09z^{-2}}$$

Realize the system in cascade and parallel structures (6,4)

VII. a) Design an ideal digital band pass FIR filter using the Hanning window with : Cut off frequency $0.3\pi \leq w_c \leq 0.6\pi$, Filter order N=10

b) Explain with an example how modified Harvard architecture allows instruction fetch from program memory and data fetch from data memory simultaneously. (2x5)

x-x-x