Exam.Code:0937
Sub. Code: 6682

2123

B.E. (Electrical and Electronics Engineering)
Seventh Semester
PE-EE-703 (i): Digital Signal Processing

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Part.

x-x-x

Q1a) Find the discrete Fourier series coefficients for the function

$$x(n) = cos\frac{\pi}{5}n + sin\frac{\pi}{6}n$$ (2 Marks)

b) Consider an analog signal $x(t) = 3\cos(100\pi t)$ is sampled at the rate of 200Hz What is the discrete time signal obtained after sampling? (2 Marks)

c) Calculate the percentage saving calculations in 512-point radix-2 FFT when compared to direct FFT? (2 Marks)

d) How the transition width of the FIR filter can be reduced in design using windows? (2 Marks)

e) State and prove Parseval's Theorem of DFT? (2 Marks)

<u>Part-A</u>

Q2a) Find the inverse z transform of

$X(z) = \frac{z(z+10)}{(z-1)(z^2-8z+20)}$ for ROC $|z|> 4$ using partial fraction method? (5 Marks)

b) Develop a DIF FFT algorithm for decomposing the DFT for N=6 and draw the flow diagram for N=3.2. (5 Marks)

Q 3a) Find the energy spectral density and autocorrelation function for the following signal $x(t) = e^{-2t}\,u(t))$?

(5Marks)

P.T.O.

b) Determine the output response of the system if

$$x(n) = 1, \quad 0 \le n \le 10$$

$$h(n) = \left(\frac{1}{2}\right)^n, \quad 0 \le n \le 10$$

Using circular convolution? (5 Marks)

Q 4 a) Consider the following difference equation

$y(n) + 2y(n-1) + 2y(n-2) = x(n)$. The initial conditions are y(-1)=0 and y(-2)=2. Find the step response of the system? (5 Marks)

b) Find the convolution of the following:

$$x(n) = u(n) - 3u(n-2) + 2u(n-4)$$

$$h(n) = u(n+1) - u(n-8)$$

(5 Marks)

Part-B

Q5a) Design a first order Butterworth LPF with 3 dB cut off frequency of 0.2π using bilinear transformation. Assume T=1 sec ? (4 Marks)

b) Design an ideal band reject FIR filter with a desired frequency response

$H_d(w) = 1$ for $|w| \le \frac{\pi}{3}$ and $|w| \ge \frac{2\pi}{3}$

Find the values of h(n) for N=11.Find H(z) using Fourier series method (6 Marks)

Q6 a) The specifications of the desired low pass digital filters are:

$$0.9 \le |H(w)| \le 1 \quad 0 \le w \le 0.25\pi$$

$$|H(w)| \le 0.24 \quad 0.5\pi \le w \le \pi$$

Design Chebyshev digital filter using impulse invariant transformation (6 Marks)

b) The transfer function of the system is given by

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

Realize the system in cascade and parallel structures (4 Marks)

Q7a) Determine the frequency response of FIR filter defined by

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

(4 Marks)

b) Explain how Harvard architecture as used by the TMS320 family differ from the strict Harvard architecture. Compare this with the architecture of a standard Von-Neumann processor. (6 Marks)

x-x-x