Exam.Code:0937
Sub. Code: 6682

2123

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 Part.

x-x-x

Q1a) Find the discrete Fourier series coefficients for the function

$$x(n) = sin^2\left(\frac{\pi}{6}n\right)$$

(2 Marks)

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

(2 Marks)

c)How will you compute IDFT using radix 2 FFT algorithm?

(2 Marks)

d) Why Gibb's oscillations are developed in rectangular window and how can it be eliminated or reduced?

(2 Marks)

e) State and prove circular frequency shift property of DFT?

(2Marks)

Part-A

Q2a) Find the inverse z transform of

$X(z) = \frac{z(z^2+z-30)}{(z-2)(z-4)^3}$ 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=2.3

(5 Marks)

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

(5Marks)

b) Determine the output response of the system if

$x(n) = \{1,2,3,1\}$ *and* $h(n) = \{1,1,1\}$

Using circular convolution?

(5 Marks)

Q 4 a) Consider the following difference equation

$y(n+2) - 6y(n+1) + 8y(n) = x(n)$. Where $x(n) = \left(\frac{1}{4}\right)^n u(n)$.The initial conditions are y(0)=1 and y(1)=2. Find the i) zero state response , ii) zero input response and iii) total response

(5 Marks)

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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) A LPF has the desired response as given below

$$H_d\,(w) = \begin{cases} e^{-j3\omega} & 0 \le w \le 0.5\pi \\ 0 & 0.5\pi \le w \le \pi \end{cases}$$

Determine filter coefficients h(n) for N=7 using type 1 frequency sampling technique. (6 Marks)

Q6 a) Design a digital Butterworth filter satisfying the following specifications:

$$0.707 \le |H(w)| \le 1 \quad 0 \le w \le 0.5\pi$$

$$|H(w)| \le 0.2 \quad 0.75\pi \le w \le \pi$$

With T=1 seconds using impulse invariant transformation (6 Marks)

b) The transfer function of the system is given by

$$H(z) = \frac{(1+z^{-1})^3}{(1-\frac{1}{4}z^{-1})(1+z^{-1}+\frac{1}{2}z^{-2})}$$

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

Q7a) Realize the FIR system in direct form and cascade form

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

(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