[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

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B. Tech 7th Semester Examination

Digital Signal Processing (NS)

EC-413

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i) Attempt five questions in all selecting one question each from sections A, B, C and D. Section-E is compulsory.

(ii) All parts of a question should be answered at one place.

(iii) Answers should be brief and to-the-point and be supplemented with neat sketches.

SECTION - A

1. (a) Explain sampling rate conversion by a rational factor and derive Input output relation in both time and frequency domain.

   (b) An LTI system has an impulse response $h(t) = e^{-at} u(t)$; when it is excited by an input signal x (t), its output is $y(t) = [e^{-bt} - e^{-ct}] u(t)$ Determine its input x (t).

   (c) Describe the properties of Z-transform and inverse Z-Transform. (10+5+5=20)

2. (a) Find the energy content in the signal $x(n)=e^{-n/10} \sin(2\pi n/4)$

   (b) What is a signal? What are different types of signal?

   (c) Find the impulse response of a system characterized by the differential equation

   $y(t) + ay(t) = x(t)$. (10+5+5=20)

SECTION - B

3. (a) What is DIT algorithm; Explain with help of an example? Write the similarity and difference between DIT and DIF algorithm.

   (b) Compute the eight point DFT for the sequence

   $X(n) = 1,\ 0 \le n \le 7$

   0, otherwise

   By Using the DIF-FFT algorithm (10+10=20)

4. (a) Explain the radix 2 DIF-FFT algorithm and compare it with DIF-FFT algorithm.

   (b) Calculate eight point DFT of sequence

   X(n)={1/2, 1/2, 1/2, 1/2,0,0,0,0}

   Using the radix-2 DIT algorithm (10+10=20)

SECTION - C

5. (a) Explain in detail Butterworth filter and compare it with Chebyshev's filter.

   (b) Obtain the Direct form I and Direct form II realization for the system

   $Y(n)=-0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2)$ (10+10=20)

6. (a) Design a fifth order band pass linear phase filter for the following specifications.

   (i) Lower cut-off frequency = 0.4 πrad/sec

   (ii) Upper cut-off frequency = 0.6 πrad/sec

   (iii) Window type = Hamming

   Draw the filter structure.

   (b) Realize the system function h(z)=(2/3)z +1+ (2/3)z' by linear phase FIR structure. (10+10=20)

SECTION - D

7. (a) What is wavelet transform and how it can be differentiated from short time Fourier transform, explain with example.

   (b) Explain addressing schemes & interface details of TEXAS INSTRUMENT DSP module. (10+10=20)

8. (a) Explain types of wavelet transform. And give application of wavelet transform.

   (b) Explain the architecture of DSP TMS 320C54xx and give some examples of types of instruction. (10+10=20)

SECTION - E

9. (a) Write the expression for location of poles of normalized Butterworth filter.

   (b) State the properties of FIR filters.

   (c) Explain with example LTI system.

(d) State the advantages of FFT over DFTs.

(e) Find the Fourier transform of a rectangular pulse existing between

t = –T/2 to t = T/2 is a

(f) Find region of convergence of the z-transform of the signal 2^n u (n) – 3^n u (n-1).

(g) Define Decimation and Interpolation.

(h) How many multiplication & addition are required to calculate N point DFT using radix -2 FFT.

(i) Compare Hamming and Hanning window?

(j) What is the advantage of Direct form II realization over Direct form I realization? (10×2=20)