Code: 13A04602 **R13**

B.Tech IV Year I Semester (R13) Regular Examinations November/December 2016

DIGITAL SIGNAL PROCESSING

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) If N-point sequence $x(n)$ has the N-point DFT $X(k)$)., what is the DFT of $x(n-l)$

(b) Write the Parsaval 's theorem of DFT.

(c) Give the similarities and differences between DIT and DIF FFT algorithms.

(d) What is meant by split radix FFT?

(e) What is the main advantage of Direct form II realization over Direct form – I?

(f) Sketch the signal flow graph of a first order IIR digital filter.

(g) Mention the advantages & disadvantages of bilinear transformation.

(h) Give the desirable characteristics of the window functions used in FIR filters.

(i) Name the filter used along with an upsampler and justify its purpose.

(j) Mention few applications of multirate sampling.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Formulate the relation between DFT and Z transform.

(b) Compute the 4 point DFT of the sequence $x(n) = \{1, 1, -2, -2\}$

OR

3 (a) If $x_1(n)$ and $x_2(n)$ are finite duration sequences with length L and DFTs $X_1(k)$ and $X_2(k)$, prove that if $X_3(k) = X_1(k). X_2(K)$ and $x_3(n)$ is the convolution of $x_1(n)$ and $x_2(n)$.

(b) Compute the N-point DFT of $x(n) = a^n$ for: (i) $|a| < 1$. (ii) $a = 1$.

UNIT – II

4 (a) Draw the 8-point flow diagram of radix-2 DIF-FFT algorithm.

(b) Find the DFT of the sequence x(n) = {1,2,3,4,4,3,2,1} using the above algorithm.

OR

5 (a) Describe the decimation in time radix-2 FFT algorithm to determine N-point DFT

(b) Compare the computational complexity of FFT and direct calculation of DFT for 8 and 16 points.

UNIT – III

6 For the given discrete time IIR system, obtain the cascade and parallel form realizations:

$$y(n) = -0.1y(n-1) + 0.2\,y(n-2) + 3\,x(n) + 3.6x(n-1) + 0.6x(n-2)$$

OR

7 (a) Realize the FIR system in linear phase realization with minimum number of multipliers.

$$H(z) = 1 + \frac{1}{3}z^{-1} + \frac{1}{4}z^{-2} + \frac{1}{4}z^{-3} + \frac{1}{3}z^{-4} + z^{-5}$$

(b) Obtain the lattice structure for the given FIR system given by the difference equation:

$$y(n) = 2x(n) + \frac{4}{5}x(n-1) + \frac{3}{2}x(n-2) + \frac{2}{3}x(n-3)$$

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UNIT – IV

8 Using bilinear transformation, design a high pass filter monotonic in pass band with a cut off frequency of 1000 Hz and down 10dB at 350 Hz. The sampling frequency is 5000 Hz.

OR

9 Determine the filter coefficients obtained by sampling $H_d\ (e^{j\omega})$ for N = 7.

$$H_d\ (e^{j\omega}) = e^{-j(N-1)\omega/2},\ 0 \le |\omega| \le \frac{\pi}{2}$$

$$= 0\ ,\quad \frac{\pi}{2} \le |\omega| \le \pi$$

UNIT – V

10 Describe the process of decimation by an integer factor. With neat diagrams, explain the spectrum for the down sampled signal.

OR

11 (a) Describe the process of interpolation and sketch the original and upsampled signal.

(b) Explain sampling rate conversion by an arbitrary factor that can be implemented.

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