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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B. E. - Electronics and Communication Engineering

Semester End Examination, Dec. - 2014

Digital Signal Processing

Time: 3 hrs *Max. Marks: 100*

Note: *i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
ii) Butter Worth and Chesyshev Polynomial table may be provided.

PART - A

1. a. Define DFT. Obtain the relationship between DFT and Z-transform. 6

   b. Compute 5 point DFT of the sequence

   $x(n)=\{\underset{\uparrow}{1},0,1,0,1\}$ and hence verify the symmetry property. 7

   c. Find N point DFT of the sequence

   $x(n)=\cos\left(\frac{2\pi n}{N}\right) 0\le n\le N-1$ 7

2 a. Verify Parseval's theorem for the sequence $x(n)=\left(\frac{1}{2}\right)^n\left[u(n)-u(n-4)\right]$ 6

   b. Use DFT and IDFT to compute circular convolution of the following sequences

   $x_1(n)=\{\underset{\uparrow}{1},2,3,1\}$ and $x_2(n)=\{\underset{\uparrow}{4},3,2,2\}$ 6

   c. Use overlap save method to find linear convolution of the following sequences:

   $x(n)=\{1,2,-1,2,3,-2,-3,-1,1,2,-1\}$ and $h(n)=\{1,2\}$ 8

3 a. Derive Radix-2, DIT FFT algorithm for computing N Point DFT. Draw the signal flow graph for N = 8. 10

   b. Compute 8 point DFT of the following sequence using DIT FFT algorithm.

   $x(n)=\begin{cases}1 & for -3\le n\le 3\\ 0 & otherwise\end{cases}$ 10

4 a Show how chirp-Z transform can be used for computing Z-transform of a N point Z-transform of a N point sequence. Also show the Block diagram representation for the same. 10

   b. Compute DFT of the following Real Sequences using DIF FFT flow graph. Compute DFT only once.

   $x_1(n)=\{1,1,1,1\}$
   $x_2(n)=\{2,1,2,1\}$ 10

Contd…2

PART - B

5 a. Design an analog Chesyshev filter for the following specifications:

Pass band ripple : 1 dB for $0 \le \Omega \le 10$ r/s

Stop band attenuation : 60 dB for $\Omega \ge 50$ r/s — 10

b. Design a 4th order High pass analog Butter worth filter for cut off frequency 50Hz. — 5

c. Write a note on frequency transformation. — 5

6 a. Compare FIR and IIR filters. — 5

b. Mention limitation & constraints of Fourier series method of designing FIR filter. — 5

c. Design a normalized linear phase FIR filter having a phase delay of $\tau = 4$ and atleast 40 dB attenuation in the shop band. Also obtain the magnitude of frequency response of the filter. — 10

7 a. Let $H(S) = \dfrac{S+a}{(S+a)^2 + b^2}$ be a second order causal analog filter. Obtain H(z) using Impulse invariance method. Take the sampling period to be T sec. — 10

b. Using BLT, design a Butter Worth filter to meet the following specifications. — 10

$$0.8 \le |H(w)| \le 1 \quad 0 \le w \le 0.2\pi$$
$$|H(w)| \le 0.2 \quad 0.6\pi \le w \le \pi$$

Take T = 1 sec.

8 a. Obtain the cascade and parallel form realization for the system whose system function is given by — 10

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

b. An FIR filter is described by the difference function : — 10

$$y(n) = x(n) + 3.1x(n-1) + 5.5x(n-2) + 4.2x(n-3) + 2.3x(n-4)$$

Obtain Lattice realization of the filter. Also draw its direct form – I structure.

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