Registration No. : | | | | | | | | | | |

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B. Tech

PCEC 4304

Sixth Semester (Special / Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : AEIE, EC, EEE, ETC, IEE

QUESTION CODE : E 312

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) Find out frequency response of the system whose impulse response is described as $h(n) = a^n u(n)$.

(b) The following analog signal is sampled at 8,000 samples per second.

$x(t) = \sin(1250t) + 2\cos(1000\pi t)$

What is corresponding discrete time signal after sampling ?

(c) What is approximate transition width of main lobe in the rectangular window ? What happens to it if you double the filter length ?

(d) How many real multiplication and real additions are required to compute 16 point DFT using decimation in frequency (DIF) algorithm ?

(e) Draw the basic structure of 1st order digital IIR filter.

(f) What are the properties of FIR filter ?

(g) State the final value theorem in Z-transform.

P.T.O.

(h) Give the mapping of S-plane to Z-plane using impulse invariance method.

(i) State circular frequency shifting property of DFT.

(j) Why FIR filters are inherently stable ?

2. (a) Consider the LTI system described by the equation. 5

$x(n) = a^n u(n) - b^n u(-n-1)$.

What conditions must hold on a and b for Z-transform to exist ? 4

(b) Determine the response of the system 6

$y(n) = 0.8y(n-1) + 0.2y(n-2) + x(n)$

to the input signal $x(n) = \delta(n) - \delta(n-1)$

3. (a) Explain the design of linear phase FIR filter using windows. 5

(b) Convert the analog filter with the system function

$$H(s) = \frac{s + 0.1}{(s+0.1)^2 + 9}$$

Into a digital IIR filter using impulse invariance method. 5

4. (a) Find the impulse response of LTI system whose frequency response is described as 5

$H(e^{jw}) = 1 \quad$ For $|w| < \pi/4$

$= 0 \quad$ otherwise

(b) Explain the Design of linear phase FIR filter using frequency sampling method. 5

5. (a) Consider the casual system 5

$Y(n) = 0.75y(n-1) - 0.125y(n-2) - x(n) + 0.3x(n-1)$

Obtain direct form I and form-II structure

(b) Explain linear phase and stability property of FIR and IIR filters 5

6. (a) Perform the convolution of the following two sequence using Z-transform

$X^1(n) = \{2,1,0, \quad 1\}$

$X^2(n) = \{1,2, -1.1\}$ 5

(b) Explain how DFT can be used in linear filtering the discrete signal. 5

7. (a) Explain Decimation in time FFT algorithm. 5

(b) What is N-point DFT ? Find 4-pont DFT of the discrete signal,

$X(n) = \{0,1,2,3\}$ 5

8. Write short notes on any **two** of the following : 5×2

(a) Linear phase FIR filter by frequency sampling method

(b) Stability of LTI system

(c) Adaptive Line Enhancer

(d) Minimum Mean Square Error Criterion.