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

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B. Tech

PCEC 4304

Sixth Semester Regular / Back Examination – 2015

DIGITAL SIGNAL PROCESSING

BRANCH(S) : AEIE, IEE

QUESTION CODE : J 203

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) Express the transfer function of a 1st order digital FIR filter using z-transform.

(b) State the scaling property of the z transform.

(c) What is paley-weiner theorem ? What is its importance ?

(d) State the magnitude response of the system described by

$$y(n) = 0.5Y(n-1) + X(n-2)$$

(e) How many real multiplication and addition is required for computation of N-point DFT ?

(f) What are the two conditions that must be satisfied for a filter to behave as linear phase characteristics ?

(g) How ripples in the pass band of FIR filters can be eliminated ?

(h) State the limitations of bilinear transformation method for realizing IIR filter.

(i) State two practical difficulties that are generally encountered during designing of FIR filter.

(j) What is adaptive in adaptive filter ? How it is different from classical filter ?

P.T.O.

2. (a) Find the Z-transform of the following signal using property. 4

$x(n) = 1 \quad \text{for } 0 < n < 11$

$= 0 \text{ otherwise}$

(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 Pole –Zero pattern of FIR filters with suitable example. 5

(b) Find the impulse response of LTI system whose frequency response is described as 5

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

$= 0 \quad \text{otherwise}$

4. (a) Establish the relation between ω and Ω using bilinear transformation. And then, bring out a mapping between them. 5

(b) Design a single pole low pass digital filter with 3-dB bandwidth of 0.2Π, using bilinear transformation applied to the analog filter 5

$$H(s) = \frac{\Omega}{s+\Omega}$$

Where Ω is the 3-dB bandwidth of an analog filter.

5. (a) Consider the casual system 6

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

Obtain direct form I and form-II structure.

(b) Explain the frequency sampling structure of FIR filter. 4

6. (a) The DFT of x(n) is described as $X(k) = \{1, -1+2j, -1, 1+2j\}$. Find the DFT of $x^2(n)$. 5

(b) What is N-point DFT ? Find 4-pont DFT of the discrete signal, $X(n) = \{0, 1, 2, 1\}$. 5

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

(b) What is adaptive filter ? How it can be used to identify an unknown system ? 5

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

(a) Adaptive Noise Cancelling

(b) Stability of LTI system

(c) Windows used in designing FIR filter

(d) Use of DFT in linear filtering.