Registration No. :

Total number of printed pages – 2

B. Tech

PCEC 4304 (New)

Sixth Semester (Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : AEIE

QUESTION CODE : B246

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) Determine the ROC of the signal given by
    $$x(n) = (0.5)^n u(n) - (0.8)^{-n} u(-n-1).$$

    (b) State and prove the differentiation property of Z-transform.

    (c) What are the properties of Twiddle factor ?

    (d) What is rhe basic difference between DTFT and DFT ?

    (e) What is the speed of improvement factor in calculation 64 point DFT of a sequence using direct computation and computation with FFT algorithm ?

    (f) What is zero padding ? What are its uses ?

    (g) Why the result of circular and linear convolution is not the same ? Explain with an example.

    (h) Sketch the mapping of s-plane to z-plane in bilinear transformation method.

    (i) What is the necessary and sufficient condition for the linear phase characteristics of an FIR filter ? Draw the direct form realization of linear phase filter for even number of samples.

    (j) Differentiate between linear filters and adaptive filters.

2. (a) Determine all possible signals x (n) associated with the z-transform.   6
    $$X(z) = \frac{5z^{-1}}{3 - 7z^{-1} + 2z^{-2}}$$

P.T.O.

(b) By first differentiating $X(z)$ and then using appropriate properties of the z-transform, determine $x(n)$ for the following transform : 4

$$X(z) = \log(1 - 2z) \qquad |z| < \frac{1}{2}$$

3. (a) What is sectioned convolution any why is it required ? Describe the structural difference between overlap save and overlap add method. 3

(b) Compute the convolution of a long data sequence using overlap save method for the given sequences. 7

$x(n) = \{1, -1, 2, 3, -4, 1, 2, 8, 3, 1, 7, 8, 2, 0, 0, 1, 5, 4\}$

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

4. Design an FIR digital filter approximating the ideal low frequency response.

$$H_d(\varpi) = \begin{cases} 1, & |\varpi| \le \dfrac{\pi}{6} \\[2mm] 0, & \dfrac{\pi}{6} \le |\varpi| \le \pi \end{cases}$$

(a) Determine the co-efficients of 15 tap filter based on window method with rectangular window. 5

(b) Realize the filter using Direct Form structure. 5

5. Determine the DFT of the following 8-point sequence with appropriate butterfly diagram using DIF-FFT method : 10

$x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$

6. Design and realize a digital low pass filter using bilinear transformation to satisfy the following requirements : 10

(a) Monotonic stop band and pass band

(b) -3 dB cut-off frequency at 0.6π radians and

(c) Magnitude down at 16 dB at 0.75π radians.

7. (a) What is DCT ? How does it differ from DFT ? Derive an expression for Forward and Inverse type II DCT. 6

(b) Prove that DCT is an orthogonal transform. 4

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

(a) System Identification

(b) DFT as a linear transformation

(c) Impulse invariance method of IIR filter design

(d) Adaptive Line Enhancer.

_____