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Total number of printed pages – 3

B. Tech  
PCEC 4304(New)

Sixth Semester (Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : CSE, ELECTRICAL

QUESTION CODE : B248

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) A communication link carries binary coded words representing samples of an input
- $x(t) = \sin(2000t) + 2 \cos(1500\pi t)$
- The link is operated at 10,000 samples per second. Find sampling frequency and niquist sampling rate of the link.
- (b) Express impulse function  $\delta(n)$ . in terms of step function  $U(n)$ .
- (c) What do you mean by region of convergence (ROC) ? What is importance in discrete time system ?
- (d) What is time reversal property of DFT?.
- (e) How many real multiplication and real additions are required to compute 8 point DFT?
- (f) Why IIR filters does not have Linear phase characteristics ?
- (g) What is discrete Hilbert transform? What is its physical significance ?
- (h) How can you compute Fourier transform form Z-transform ?

P.T.O.

- (i) What are different bands in a digital filter ? At which band an ideal filter is distortion less ?
- (j) Why aliasing occurs most of the time when mapping of s-plane to z-plane is done using impulse invariance sampling method ?
2. (a) Determine the response  $y(n)$ ,  $n \geq 0$ , of the system described by the following difference equation. 6

$$y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1).$$

When input sequence is

$$x(n) = a^n u(n)$$

- (b) State and prove scaling property of Z-transform. 4
3. (a) Establish the relation between  $\omega$  and  $\Omega$  using bilinear transformation. And then, bring out a mapping between them. 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 bilinear transformation method 5

4. Determine the coefficient of linear phase FIR filter length  $M = 15$ , which has a symmetric unit sample response and frequency response that satisfies the condition 10

$$\begin{aligned} \text{Hr} \left( \frac{2\pi k}{15} \right) &= 1 & K = 0,1,2,3 \\ &= 0.4 & K = 4 \\ &= 0 & K = 5,6,7 \end{aligned}$$

5. (a) Consider the casual system 5
- $$Y(n) = 0.1y(n-1) - 0.72y(n-2) + 0.7x(n) - 0.252x(n-1)$$
- Obtain a cascade structure of the system
- (b) Discuss the merits and demerits of IIR and FIR digital filters. 5

6. (a) Establish the relation between DFT and Z-transform 5  
(b) Perform the circular convolution of the following two sequences : 5  
 $X^1(n) = \{2, 1, 2, 1\}$   
 $X^2(n) = \{1, 2, 3, 4\}$  5
7. (a) Explain Decimation in frequency FFT algorithm. 5  
(b) What is the physical significance of DFT ? Find 4-point IDFT of the signal,  
 $X(n) = \{1, 0, 2, 1\}$  . 5
8. Write short notes on any **two** of the following : 5×2
- a) Use of FFT in linear filtering
  - b) Line Enhancer
  - c) Overlap-add method
  - d) Adaptive Noise Cancelling

