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Total number of printed pages – 2

B. Tech
PCEC 4304

Sixth Semester Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : EC / ETC

QUESTION CODE : A 152

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) What is the minimum required sampling rate for an analog signal of the form $\sin(200\pi t) + \cos(50\pi t)$ to avoid aliasing ?
 - (b) Sketch $x(-n + 5)$.
 - (c) What is Gibbs phenomenon ?
 - (d) Prove that DFT is a linear operation.
 - (e) What are advantages of FFT over DFT ?
 - (f) Why IIR filters does not have Linear phase characteristics ?
 - (g) State convolution property of Z-transform.
 - (h) How can you compute Fourier transform form Z-transform ?
 - (i) Find the impulse response the LTI system shown below :
$$Y(n) = 0.5x(n - 1) + 2x(n)$$
 - (j) What is the stability condition of an LTI system ?
2. (a) Find out the impulse response of the system. 3+3
$$y(n) = 0.5y(n - 1) + 0.2y(n - 2) + 0.4x(n) + x(n - 1)$$

Locate the poles and Zeros. Is the system is stable ?

P.T.O.

- (b) Using Z-transform, find the step response of the system described by $y(n) = y(n - 1) + 2x(n - 2)$ 4
3. (a) Bring out mapping between ω and Ω ? Where it is used ? 5
- (b) Design a single pole low pass digital filter with a 3-dB bandwidth of 0.3π by use of bilinear transformation applied to the analog filter $H(s) = \frac{\Omega}{s + \Omega}$ where Ω is the 3-dB bandwidth of the analog filter. 5
4. (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 II and parallel structure of the system
- (b) State the difference between IIR and FIR filter. 4
5. (a) Find inverse Z-transform of the casual signal $x(n)$ whose Z-transform is given as 5

$$X(z) = \frac{1}{1 - 1.5z^{-1} - 0.5z^{-2}}$$
- (b) Determine pole - zero plot for the discrete signal 5

$$x(n) = a^n \quad 0 \leq n \leq M - 1$$

$$= 0 \quad \text{otherwise}$$
 Where, $a > 0$
6. (a) Explain Decimation in frequency FFT algorithm. 5
- (b) What is the physical significance of IDFT ? Find 4-pont IDFT of the signal, $X(k) = [1, 0, 0, 1]$. 5
7. Write short notes on any **two** : 5×2
- (a) System Modeling
- (b) Stability of LTI system
- (c) Overlap-save method
- (d) The LMS Algorithm.