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

*Total number of printed pages – 3*

B. Tech

FECS6401

# Seventh Semester (Special) Examination – 2013

## INTRODUCTION TO DIGITAL SIGNAL PROCESSING

**BRANCH : CSE, IT**

**QUESTION CODE : D 453**

**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 sampling theorem ? Find the Niquist rate of sampling of the signal given below :

$25\sin(2500\pi t)\times 3\cos(400\pi t) - \cos(1750\pi t)$

(b) What is unit of $Z^{-1}$ ?

(c) State the difference between IIR and FIR filter.

(d) What is even and odd signal? Express a signal $x(n)$ in terms of even and odd component.

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

(f) What is linear phase characteristics of FIR filter ?

(g) What are advantages of FFT over DFT ?

(h) Give the mapping of S-plane to Z-plane using bilinear transformation technique.



P.T.O.

(i) A casual signal is represented as,

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

Express the signal as the sum of impulse function $\delta(n)$.

(j) What is Gibbs phenomenon ?

2. (a) Find out the impulse response of the system 5

$y(n) = 0.5\,y(n-1) + 0.2y(n-2) + 0.4x(n) + x(n-1)$

Locate the poles and Zeros. Is the system stable ?

(b) Determine the steady state response of the system described by 5

$h(n) = 0.5\,y(n-1) + y(n-2) + 0.25\,x(n-1)$

When a unit step function is applied to the system.

3. (a) Using Z-transform, find the step response of the system described by 5

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

(b) Find inverse Z-transform of the casual signal x(n) whose Z-transform is given as 5

$$X(z) = \frac{1}{1 - 1.5z^{-1} - 0.5z^{-2}}$$



4. (a) Convert the analog filter with system function

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

Into a digital IIR filter using impulse invariance transformation method. The digital filter is to have resonant frequency of $\frac{\pi}{2}$. 5

(b) Bring out mapping between $\omega$ and $\Omega$. Where it is used ? 5

5. (a) Consider the casual system 5

$Y(n) = 0.9\,y(n-1) - 0.08\,y(n-2) + x(n) + 0.3\,x(n-1)$

Obtain a cascade structure of the system

(b) Explain the design of linear phase FIR filters using window technique. 5

6. 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

$$Hr\left(\frac{2\pi K}{15}\right) = 1 \qquad K = 0,1,2,3$$

$$= 0.4 \qquad K = 4$$

$$= 0 \qquad K = 5,6,7$$

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

(b) Find 4-pont IDFT of the signal, X(k) ={1, 1,1,1} using Decimation in time algorithm. 5

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

(a) Stability of LTI system

(b) Overlap-save method

(c) Circular convolution

(d) Use of DFT in linear filtering.