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

Total number of printed pages – 3

B. Tech

PCEC 4304(New)

Sixth Semester (Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : EEE, MECH

QUESTION CODE : B 247

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 : 2×10

(a) Find the Niquist rate of sampling of the mixed signal given below :
Sin (2000 Π t) + Cos (5000t)

(b) State the time reversal property of the z transform.

(c) Why FIR filters are inherently stable ?

(d) Express Unit step function U(n) in terms of in terms of impulse functions $\delta(n)$.

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

(f) Draw the basic structure of 1st order digital FIR filter.

(g) Sketch the signal x(– n + 4) When X(n) = (1, 1, 0, 1).

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

(i) Find the impulse response of the system which is described by the difference equation
Y(n) = 0.5x(n – 1) + 2x(n)

(j) What is circular convolution ?

P.T.O.

2. (a) Determine the stability region of the casual system 4

$$X(z) = \frac{1}{1 - az^{-1} + bz^{-2}}$$

(b) Determine the transient and steady state response of the system described by $x(n) = y(n-1) + 2y(n-2)$

When an unit step function is applied to the system. 6

3. (a) Determine eight point DFT of the following signal : 5

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

(b) Find inverse Z-transform of : 5

$X(z) = \log(1 - az)$ $|z| > |a|$

4. Determine the order and poles of a low pass Butterworth filter that has 3-dB bandwidth is 500 Hz and attenuation of 40 dB at 1000 Hz. Sketch the poles of proposed filter transfer functions. 10

5. (a) Consider the casual system 4

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

Obtain parallel structure of the system

(b) Explain the Design of linear phase FIR filter using frequency sampling method. 6

6 (a) Explain the design procedure for IIR filter using impulse invariance method. 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.

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

(b) Find 4-pont IDFT of the signal, $X(k) = \{1,1,0,1\}$ and sketch magnitude response. 5

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

(a) Channel Equalization

(b) Linear-Phase FIR Filters using windows

(c) Circular convolution

(d) Use of DFT in linear filtering.