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

Total number of printed pages – 3

B. Tech

PCEC 4304

Sixth Semester Back Examination – 2015

DIGITAL SIGNAL PROCESSING

BRANCH (S) : EC, ETC

QUESTION CODE : M 130

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 aliasing effect ? What is the minimum required sampling rate for an analog signal of the form Sin(1000t) +2sin(200t) cos(500π t) to avoid aliasing ?

(b) What is time shifting property of z-transform ?

(c) Express a discrete unit step functions in terms of discrete unit impulse functions.

(d) What is the stability condition of an LTI system ?

(e) What do you mean by region of convergence (ROC) ? What is importance in discrete time system ?

(f) When DFT x (k) of a sequence x (n) is real ?

(g) Why IIR filters does not have Linear phase characteristics ?

(h) Why aliasing occurs most of the time when mapping of s-plane to z-plane is done using impulse invariance sampling method ?

(i) What type of filter best describes the LMS algorithm ? Give its schematic representation.

(j) Find the impulse response the LTI system shown below :

$Y(n) = 0.5x(n-1) + 2x(n)$

P.T.O.

2. (a) Determine the response $y(n)$, $n \geq 0$, of the system described by the following difference equation. $y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1)$. When input sequence is $x(n) = a^n u(n)$. 6

(b) Determine the transient and steady state response of the system described by $x(n) = y(n-1) + 2y(n-2)$ When a unit step function is applied to the system. 4

3. (a) Perform the convolution of the following two sequence using DFT properties

$X1(n) = \{1, 1, 1, 0\}$

$X2(n) = \{1, 1, 0, 1\}$ 5

(b) Determine the range values of parameter a for which the LTI system with impulse response : 5

$$x(n) = a^n \quad n > 0, \quad n \text{ even}$$
$$= 0 \quad \text{otherwise}$$

Is stable

4. (a) Establish the relation between ω and Ω using bilinear transformation. And then, bring out a mapping between them. 5

(b) Using bilinear transformation method, Design a high pass filter, monotonic in pass band with cutoff frequency of 1000 Hz and down 10 dB at 350 Hz. The sampling frequency is 5000 Hz. 5

5. (a) Discus the merits and demerits of IIR and FIR digital filters. 6

(b) Find the impulse response of LTI system whose frequency response is described as : 4

$$H(e^{jw}) = 1 \quad \text{For } |w| < \pi/4$$
$$= 0 \quad \text{otherwise}$$

6. (a) 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

(b) Consider the casual system : 5

$$Y(n) = 0.75y(n-1) - 0.125y(n-2) + x(n) + 0.3x(n-1)$$

Obtain direct form I and form II structure of the system.

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

(b) What is adaptive in adaptive filter ? Explain how adaptive filter is used as to identify an unknown system ? 5

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

(a) Overlap-add method

(b) Inverse DCT and its importance

(c) Adaptive Noise Cancelling

(d) FIR filter using windowing technique.