Registration No. :

Total number of printed pages – 3

B. Tech

CPEC 5302 (Old)

Sixth Semester (Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : AEIE

QUESTION CODE : B344

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

    $\sin(1000t) + 2\sin(200t)\cos(500\pi t)$ to avoid aliasing ?

    (b) Sketch $U(-n+5)$.

    (c) Give an example with justification of a power signal which is not an energy signal.

    (d) What is recursive and non-recursive LTI system ?

    (e) What are advantages of IIR filters ?

    (f) Why FIR filters are inherently stable ?

    (g) State time shifting property of Z-transform.

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

    (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 ?
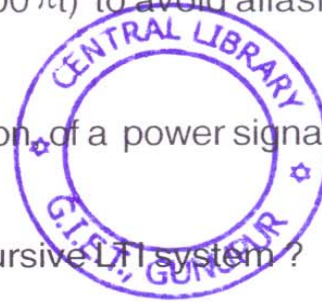
P.T.O.

2   Find out the impulse response of the system   10

$$y(n) = 2y(n-1) + y(n-2) + 0.5x(n) + x(n-1).$$

And then find out, wheather the system is

(a)   Static and dynamic

(b)   Time variant and Time invariant

(c)   Casual and non-casual

(d)   Linear and non-linear

3.   (a)   Find out auto corelation of the following signal   5

$$x(n) = a^n u(n), \quad 0 < a < 1$$

(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)   Determine Z-transform of the following signal   6

(a) $x(n) = n^2 u(n),$

(b) $x(n) = \cos(wn)\, u(n)$

(b)   Establish the inverse Z-transform of X(Z) using Contour integration.   4

5.   (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 I and form II structure of the system.

(b)   State the difference between IIR and FIR filter.   4

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

$$X(z) = \frac{1}{1 - 0.5z^{-1} + 0.25z^{-2}}$$

(b) Convert the analog filter with system function. 5

$$H(s) = \frac{s+1}{(s+1)^2 + 16}$$

Into a digital IIR filter using billinear transformation. The digital filter is to have a resonant frequency of $\omega_r = \Pi/2$.

7. (a) Explain Decimation in Time FFT algorithm.

(b) What is the physical significance of DFT ? Find 4-point DFT of the signal, $X(n) = \{1,0,0,1\}$.

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

(a) System Modeling

(b) Stability of LTI system

(c) Overlap-save method

(d) The system identification

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