

Registration No. :

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Total number of printed pages – 3

B. Tech
PCEC 4304

Sixth Semester (Special / Back) Examination – 2013

DIGITAL SIGNAL PROCESSING

BRANCH : AEIE, EC, EEE, ETC, IEE

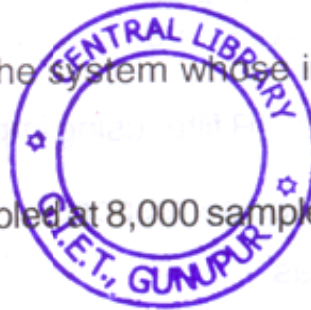
QUESTION CODE : E 312

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) Find out frequency response of the system whose impulse response is described as $h(n) = a^n u(n)$.
- (b) The following analog signal is sampled at 8,000 samples per second.
 $x(t) = \sin(1250t) + 2 \cos(1000\pi t)$
What is corresponding discrete time signal after sampling ?
- (c) What is approximate transition width of main lobe in the rectangular window ? What happens to it if you double the filter length ?
- (d) How many real multiplication and real additions are required to compute 16 point DFT using decimation in frequency (DIF) algorithm ?
- (e) Draw the basic structure of 1st order digital IIR filter.
- (f) What are the properties of FIR filter ?
- (g) State the final value theorem in Z-transform.



PCEC 4304
P.T.O.

- (h) Give the mapping of S-plane to Z-plane using impulse invariance method.
- (i) State circular frequency shifting property of DFT.
- (j) Why FIR filters are inherently stable ?
2. (a) Consider the LTI system described by the equation. 5
 $x(n) = a^n u(n) - b^n u(-n - 1)$.
 What conditions must hold on a and b for Z-transform to exist ? 4
- (b) Determine the response of the system 6
 $y(n) = 0.8y(n - 1) + 0.2y(n - 2) + x(n)$
 to the input signal $x(n) = \delta(n) - \delta(n - 1)$
3. (a) Explain the design of linear phase FIR filter using windows. 5
- (b) Convert the analog filter with the system function
- $$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$
- Into a digital IIR filter using impulse invariance method. 5
4. (a) Find the impulse response of LTI system whose frequency response is described as 5
- $$H(e^{j\omega}) = 1 \quad \text{For } |\omega| < \pi/4$$
- $$= 0 \quad \text{otherwise}$$
- (b) Explain the Design of linear phase FIR filter using frequency sampling method. 5
5. (a) 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
- (b) Explain linear phase and stability property of FIR and IIR filters 5

6. (a) Perform the convolution of the following two sequence using Z-transform

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

$$X^2(n) = \{1, 2, -1.1\}$$

5

(b) Explain how DFT can be used in linear filtering the discrete signal.

5

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

5

(b) What is N-point DFT ? Find 4-pont DFT of the discrete signal,

$$X(n) = \{0, 1, 2, 3\}$$

5

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

5 × 2

(a) Linear phase FIR filter by frequency sampling method

(b) Stability of LTI system

(c) Adaptive Line Enhancer

(d) Minimum Mean Square Error Criterion.

