Roll No. 3322976

24792

B.Tech. 6th Sem. (Electronics & Computer Engg.) Examination – May, 2014

DIGITAL SIGNAL PROCESSING

Paper : EC-614-F

Time : Three hours] *[Maximum Marks : 100*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question number 1 is ***compulsory***, and attempt one question from each of the *four* sections. All questions carry equal marks.

1. (a) Give the steps in the design of a digital filter from analog filter ? 3

(b) State the properties of FIR filter. 2

(c) Are FIR filters inherently stable ? 2

(d) Give the desirable characteristics of the window ? 2

(e) Write any *four* applications of multi-rate signal processing. 4

(f) Explain the shifting and scaling property of Z transform with suitable example. 4

(g) What do you understand by aliasing ? How will you control aliasing ? 3

SECTION – A

2. (a) What do you understand by signal ? Explain various types of signals. 8

(b) State and prove the parseval's energy theorem for discrete time signals. 12

3. (a) What do you mean by random and deterministic signals ? Explain you answer with suitable example. 8

(b) Find Fourier transform of $f(t) = e^{st}$ cosbt. 12

SECTION – B

4. (a) What is an IIR filter ? Compare an IIR filter with an FIR filter. 8

(b) Obtain the direct form I and direct form II realisations for third order IIR transfer function which is expressed as below : 12

$$H(z) = (0.28z^2 + 0.319z + 0.04)/(0.5z^3 + 0.3z^2 + 0.17z - 0.2)$$

5. (a) A digital communication link carries binary coded words representing samples of an input signal

$$X_q(t) = 3\cos 600\pi t + 2\cos 1800.t$$

the link is operated at 10,000 bits/s and each input samples is quantized 1024 different voltage levels.

(i) What are the sampling frequency and the folding frequency ?

(ii) What is the Nyquist rate for the signal $X_q(t)$? 12

(b) How will you reconstruct band limited signal from its samples ? Explain with mathematical equations. 8

SECTION – C

6. (a) Using residue method, determine x(n) for

$$X(z) = 1/(z-0.25)(z-0.5),\ \text{ROC} : |Z| > 0.5$$ 12

(b) Explain final value and initial value theorem. 8

7. (a) Using a rectangular window technique design a low pass filter with pass band gain unity, cut off frequency of 1000 Hz & working at a sampling frequency of 5 Khz. The length of the impulse response should be 7. 12

(b) Explain the finite word length effect in FIR digital filter. 8

SECTION – D

8. (a) Explain the implementation steps in speech coding using transform coding. 12

(b) Discuss the design steps involved in the implementation of multistage sampling rate converter. 8

9. Explain the efficient implementation of polyphase decimator and interpolator. 20