**D 26545** (Pages : 2)

Name.....

Reg. No.....

# SEVENTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

## EE 2K 702—DIGITAL SIGNAL PROCESSING

Time : Three Hours Maximum : 100 Marks

*Answer* **all** *questions.*

1. (a) Explain reconstruction of band limited signals from its samples.

(b) Test stability of the following system :—

$$y(n) - by(n-1) = x(n).$$

(c) Give a method of computation of inverse DFT using FFT algorithm.

(d) Describe how linear convolution can be computed using DFT.

(e) Explain the effect of parameter quantization.

(f) Define discrete state variable. Give example.

(g) What is bilinear transformation ? What are its properties ?

(h) What are the desirable characteristics of the window ?

(8 × 5 = 40 marks)

2. (a) (i) Find the Fourier transform of $x(n) = (0{\cdot}8)^{|n|}$ for all $n$. (5 marks)

(ii) A causal LTI system described by the difference equation :

$$y(n) - ay(n-1) = bx(n) + x(n-1),$$

where $a$ is real and less than 1 is magnitude. Find a value of $b$ $(a \neq b)$ such that the frequency response of the system satisfying.

$$\left|H\left(e^{jw}\right)\right| = 1 \text{ for all } w.$$

(10 marks)

*Or*

(b) (i) Discuss the stability of the system described by :

$$H(z) = \frac{1}{\left(1-\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}.$$

(5 marks)

(ii) Find the $z$-transform of the following sequence :—

$$n(n-1)x(n).$$

(5 marks)

(iii) Check the linearity, causality and time invariance of the following system :—

$$y(n) = nx(n).$$

(5 marks)

**Turn over**

3. (a) (i) State and prove shifting property of DFT. (5 marks)

(ii) Explain the decimation in time FFT algorithm with flow graph for an 8 point sequence. (10 marks)

*Or*

(b) (i) Obtain the DFT of :

$$x(n) = 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \quad 0 \le n \le 3$$
$$= 0 \quad \text{otherwise.}$$

(5 marks)

(ii) Write the relationship between DFT and $z$-transform. (5 marks)

(iii) Find the circular convolution of the following sequence :—

$x_1(n) = \{1, 2, 3, 4\}$ and

$x_2(n) = \{4, 1, 2, 1\}$.

(5 marks)

4. (a) Obtain the lattice ladder structure for the system function :

$$H(z) = \frac{1 + 3z^{-1} + 3z^{-2} + z^{-3}}{1 - \cdot 9z^{-1} + \cdot 64z^{-2} - \cdot 576z^{-3}}.$$

(15 marks)

*Or*

(b) Draw the block diagram of architecture of TMS 320C50 processor and explain function of each block.

(15 marks)

5. (a) (i) Compare the properties of Butterworth and Chebyshev filters. (5 marks)

(ii) Use impulse invariance to obtain H ($z$) if T = 1 sec. and $H(s) = \frac{s}{s^2 + 2s + 1}$. (5 marks)

(iii) Give the concept and uses of linear phase digital filters. (5 marks)

*Or*

(b) Design an FIR filter with magnitude response

$$H\left(e^{jw}\right) = j \quad \text{for} \quad -\pi \le w \le 0$$
$$= -j \quad \text{for} \quad 0 \le w \le \pi$$

using hanning window for N = 7.

(15 marks)

[4 × 15 = 60 marks]