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Name..............................

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SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2006

IT 2K 601—DIGITAL SIGNAL PROCESSING

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) State and prove time shifting property of Fourier transform.

   (b) Derive the necessary and sufficient condition for causality of an LTI system.

   (c) State and prove any *two* properties of DFS.

   (d) Draw the basic buttfly diagram of DIT-FFT algorithm and explain.

   (e) Describe impulse invariant mapping used for designing IIR filter.

   (f) Explain the design procedure of FIR filter using Kaiser window function.

   (g) Realize the following system function using minimum number of multipliers :—

   $$H(z)=1+\frac{1}{3}z^{-1}+\frac{1}{4}z^{-2}+\frac{1}{4}z^{-3}+\frac{1}{3}z^{-4}+z^{-5}.$$

   (h) Explain about limit cycle oscillations.

(8 × 5 = 40 marks)

2. (a) (i) Find the magnitude of the frequency of the system having difference equation

   $$y(n)=-\frac{1}{2}y(n-1)+x(n)$$

   and plot it.

(9 marks)

   (ii) Check whether the following system is BIBO stable or not :—

   $$y(n)=x(n)+e^{a}\,y(n-1).$$

(6 marks)

Or

   (b) Find the impulse response the system having difference equation :

   $$y(n)-\frac{5}{6}y(n-1)+\frac{1}{6}y(n-2)=x(n)+x(n-1).$$

(15 marks)

3. (a) Find the linear convolution of $x(n)=\{4, 5, 6\}$ with $h(n)=\{2, 1\}$ using DFT.

Or

   (b) Find the 8-point DFT of $x(n)=\{1, 2, 3, 4, 5, 6, 7, 8\}$ using DIT-FFT algorithm.

(15 marks)

Turn over

4. (a) Design a Butterworth digital filter for the following specifications. Use bilinear transformation with T = 1 sec.

$$0.707 \le H(\omega) \le 1, \quad \text{for } 0 \le \omega \le \frac{\pi}{5}$$

$$0 \le H(\omega) \le 0.1, \quad \text{for } \frac{\pi}{2} \le \omega \le \pi.$$

Or

(b) Design a digital FIR band-pass filter with cut-off frequencies at 0·2 rad./sec. and 0·3 rad./sec. The filter order is N = 9. Use Hamming window function.

5. (a) Determine the parallel and cascade realization of the system having system function :

$$H(z) = \frac{2(z+2)}{z(z-0.1)(z+0.5)(z+0.4)}.$$

Or

(b) Given the transfer function $H(z) = H_1(z)\,H_2(z)$, where

$$H_1(z) = \frac{1}{1-\frac{1}{2}z^{-1}} \text{ and } H_2(z) = \frac{1}{1-\frac{1}{4}z^{-1}}.$$

Compute the output roundoff noise power.

(4 × 15 = 60 marks)