K 1099

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2004.

Fifth Semester

Computer Science and Engineering

CS 331 — DIGITAL SIGNAL PROCESSING

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. When a discrete-time signal is said to be symmetric or antisymmetric?

2. Define correlation.

3. State Parseval's relation.

4. Determine the discrete time Fourier transform of the sequence $x(n) = \{1, -1, 1, -1\}$.

5. What do you understand by linear phase response?

6. What is Gibbs phenomenon?

7. What are the three quantization errors due to finite word length, registers in digital filters?

8. What are the advantages and disadvantages of bilinear transformation?

9. What is an interpolator?

10. What is known as periodogram?

PART B — ($5 \times 16 = 80$ marks)

11. (i) How to obtain linear convolution from circular convolution? Explain with an example. (8)

(ii) Find the N-point DFT of the following signals :

(1) $x(n) = \delta(n - no)$

(2) $x(n) = a^n$. (8)

12. (a) Find the cross-correlation of two finite length sequences.

(i) Finite length sequences

$x(n) = \{1, 2, 1, 1\}$; $y(n) = \{1, 1, 2, 1\}$ (8)

(ii) For the given impulse response determine whether the system is stable and causal $h(n) = \delta(n) + \sin \pi n \quad h(n) = e^{2n} u(n-1)$. (8)

Or

(b) (i) Evaluate the fourier transform of the system whose unit sample response

$h(n) = 1$ for $0 \le n \le N-1$

0 elsewhere. (8)

(ii) Describe the odd and even symmetry property of the fourier transform. (8)

13. (a) Design an ideal band pass filter with a frequency response.

$$H_d(e^{jw}) = 1 \text{ for } \pi/4 \le |w| \le 3\pi/4$$
$$= 0 \text{ otherwise}$$

Find the values of $h(n)$ for $N = 11$ and plot the frequency response. (16)

Or

(b) Design a filter with

$$H_d(e^{-jw}) = e^{-j3w} \quad -\pi/4 \le w \le \pi/4$$
$$= 0 \qquad \pi/4 \le |w| \le \pi$$

using a Hanning window with $N = 7$. (16)

14. (a) (i) Realize the system with difference equation

$$y(n) = \frac{3}{4}y(n-i) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x\ (n-i)$$

in cascade form. (8)

(ii) Describe a method to obtain the state equation $Q(n+1)$ and output equation $y(n)$ from the transfer function of the given system. (8)

Or

(b) (i) Determine $H(z)$ using impulse invariance method for the given transfer function $H(s) = \frac{2}{(s+1)(s+2)}$. Assume $T = 1$ sec. (8)

(ii) Explain the method approximation of derivatives for digitizing the analog filter into a digital filter. (8)

15. (a) (i) Explain the aliasing effect in the down sampling process if the original spectrum is not band limited to $w = \pi/M$. (8)

(ii) If x_n is a random process then prove the following : (8)

(1) $E[ax_n] = aE[x_n]$

(2) $E[x_n + a] = E[x_n] + a$.

Or

(b) (i) Describe the use of DFT in power spectrum estimation. (8)

(ii) Explain the design and implementation of filters in sampling rate conversion. (8)
