B. Tech Degree VI Semester Examination, April 2008

CS/EI/EE 601 DIGITAL SIGNAL PROCESSING

(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

I. (a) Check the linearity, time invariance, causality and stability of the following systems :

(i) $y(n) = nx(n)$ (4)

(ii) $y(n) = x(n^2)$ (4)

(iii) $y(n) = \sum_{k=-\infty}^{n} x(k)$ (4)

(b) Determine the steady state response for the system with impulse function $h(n) = \left(\frac{j}{2}\right)^n u(n)$ for an input $x(n) = (\cos \pi n) u(n)$. (8)

OR

II. (a) Explain the properties of z – transform. (10)

(b) Define system function and find the system function and impulse response of the system described by the difference equation

$$y(n) = x(n) + 3x(n-1) + 2x(n-2) + x(n-3).$$ (6)

(c) Find the stability of the system whose impulse response $h(n) = 2^n u(n)$. (4)

III. (a) Explain the properties of discrete fourier transform. (10)

(b) Find the IDFT of the sequence

$$X(k) = \{5, 0, 1-j, 0, 1, 0, 1+j, 0\}.$$ (10)

OR

IV. (a) Find the output, $y(n)$ of a filter whose impulse response is $h(n) = \{1, 1, 1\}$ and input signal $x(n) = \{3, 2, 1, 0, 1, 2, 3, -1, 2, 1\}$ using overlap save method. (10)

(b) Find the DFT of the sequence $x(n)$ using DIT FFT algorithm.

$$x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}.$$ (10)

V. (a) Explain the relevance of window function and explain each window. (10)

(b) Design a high pass filter using hamming window with a cut off frequency of 1.2 radians/sec. (10)

OR

VI. (a) Explain frequency sampling method of FIR filter design. (10)

(b) Obtain the direct and cascade form realization of the system function

$$H(z) = 1 + \frac{5}{2} z^{-1} + 2z^{-2} + 2z^{-3}$$ (10)

(Turn Over)

VII. (a) Realize the system in cascade and parallel form

$$H(z)=\frac{1+\frac{1}{2}z^{-1}}{\left(1-z^{-1}+\frac{1}{4}z^{-2}\right)\left(1-z^{-1}+\frac{1}{2}z^{-2}\right)}. \quad (10)$$

(b) Convert the analog filter with system function $H_a(S)$ in to digital filter using bilinear transformation

$$H_a(S)=\frac{S+0.1}{(S+0.1)^2+16}. \quad (10)$$

OR

VIII. (a) Explain warping effect on magnitude and phase response in an IIR filter. How this can be eliminated? (8)

(b) Design a chebyshev digital filter using impulse invariant transformation with following specification :

$$0.9 \le |H(w)| \le 1.0;\ 0 \le w \le 0.25\pi$$

$$|H(w)| \le 0.24;\ 0.5\pi \le w \le \pi \quad (12)$$

IX. Write short notes on :

(i) Fixed point and floating point arithmetic (5)

(ii) Truncation and rounding errors in digital filters (5)

(iii) Product quantization error (5)

(iv) Limit cycle oscillation (5)

OR

X. (a) Draw and explain the architecture of a typical DSP processor. (10)

(b) Explain *any one* application of digital signal processing. (10)

***