

B. Tech Degree VI Semester Examination, April 2010**CS/EI/EE 601 DIGITAL SIGNAL PROCESSING**
(2002 Scheme)

Time : 3 Hours

Maximum Marks : 100

I. (a) Test the stability, causality and linearity of the following systems :

(i) $y(n) = x(n^2)$

(ii) $y(n) = \text{Cos}[x(n)]$ (6)

(b) Find the impulse response of the system described by the difference equation.

$$y(n) - 3y(n-1) - 4y(n-2) = x(n) + 2x(n-1).$$
 (7)

(c) Determine the step response of the system whose impulse response is given by

$$h(n) = a^{-n}u(-n) \text{ for } 0 < a < 1.$$
 (7)

OR

II. (a) Find the inverse z-transform of $X(z) = \frac{1}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}$ when (i) ROC is given by $|z| < 0.5$ (ii) ROC is $|z| > 1.0$. (14)(b) Determine the response of the system whose input $x(n]$ and impulse response $h(n]$ are given by

$$x(n) = \left\{ \frac{1}{\uparrow}, 2, 3, 1 \right\}$$

$$h(n) = \left\{ 1, \frac{2}{\uparrow}, 1, -1 \right\}$$
 (6)

III. (a) Calculate the percentage saving in calculations in a 512 point radix 2 FFT when compared to direct FFT. (4)

(b) An 8 point sequence is given by

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

Compute 8 point DFT of $x(n]$ by radix 2 DIF FFT. Sketch the magnitude and phase spectrum. (16)

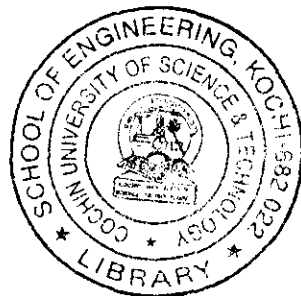
OR

IV. (a) State and prove any three properties of DFT. (6)

(b) Compute the 4-point DFT of the sequence $x(n) = \left\{ 0, 1, 2, 3 \right\}$. (5)

(c) Explain the decimation-in-time algorithm for computing DFT. (9)

(Turn Over)



- V. (a) Realize the following systems with minimum number of multipliers.

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

$$(ii) \quad H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right) \left(1 + \frac{1}{4}z^{-1} + z^{-2}\right). \quad (12)$$

- (b) What are the advantages and disadvantages of FIR filters? (5)
 (c) What is Gibb's oscillations? (3)

OR

- VI. Design a highpass filter using Hamming window with cut off frequency of 1.2 radians/sec and $N = 9$. Obtain the linear phase realization. (20)

- VII. (a) Explain the Impulse Invariant transformation method to develop an IIR filter transfer function. (10)

- (b) For an analog transfer function $H_a(s) = \frac{2}{(s+1)(s+2)}$ determine $H(z)$ if sampling time period is 0.1 sec, using impulse invariant transformation. (6)
 (c) Compare IIR filters and FIR filters. (4)

OR

- VIII. (a) Apply Bilinear transformation to the analog transfer function

$$H_a(s) = \frac{2}{(s+1)(s+2)}$$

with sampling period $T = 0.1$ sec to obtain $H(z)$. (4)

- (b) Realize the following system in parallel and cascade forms.

$$H(z) = \frac{1 + \frac{1}{2}z^{-1}}{\left(1 - z^{-1} + \frac{1}{4}z^{-2}\right) \left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}. \quad (16)$$

- IX. (a) Explain limit cycle oscillations in recursive systems. (6)
 (b) For the system described by the equation $y(n) = 0.95y(n-1) + x(n)$ determine the dead band of the system. (10)
 (c) Describe any one application of DSP. (4)

OR

- X. (a) What is overflow limit cycle? How can it be eliminated? (10)
 (b) Explain using a block diagram, the architecture of a typical DSP processor. (10)