Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech (ECE-VLSI)/SEM-2/MVLSI-202/2011

2011

DIGITAL SIGNAL PROCESSING & APPLICATIONS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer *all* questions.

1. a) Compute 8 pt DFT of the sequence :

   $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using any FFT algorithm.

   b) Find the linear convolution using circular convolution for the two sequences :

   $x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$

   $h(n) = \{1, 2, 3\}$.

   c) Compute the circular convolution of the following two sequences :

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

   $h(n) = \{1, 2, 1, 1\}$. 6 + 4 + 4

2. a) Sketch the magnitude response of Butterworth LPF filter & derive an expression for order of such a filter.

b) Design a digital Butterworth filter using the following specifications using impulse invariant method :

$0 \cdot 9 < H (jw) < 1$ for $0 < w < 0 \cdot 2 \pi$

$H (jw) < 0 \cdot 2$ for $0 \cdot 4 \pi < w < \pi$.

c) What are the advantages & disadvantages of bilinear transformation ? 5 + 5 + 4

3. a) The output and input of a recursive DT LTI system are related by the equation

$$y (n) = 0 \cdot 1 y (n - 1) + 0 \cdot 2 y (n - 2) + 3 x (n) + 3 \cdot 6 x (n - 1) + 0 \cdot 6 x (n - 2).$$

Derive and draw the direct form-II structure for realising the system.

b) Derive and sketch the cascade and parallel structure of the system with transfer function $H(z) = \dfrac{2(z+2)}{(z-0 \cdot 1)\,(z+0 \cdot 5)\,(z+0 \cdot 4)}$. 5 + 9

4. a) What is ROC ? State its properties.

b) Find the system function & impulse response of the system described by

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

c) Find the inverse Z-transform of

$$X(Z) = Z\left(Z^2 - 4Z + 5\right) \Big/ (Z-3)\,(Z-2)\,(Z-1)$$

d) Prove that an LTI system is BIBO stable if the ROC system function includes the unit circle. 2 + 5 + 4 + 3

5. Write short notes on any *two* of the following : 2 × 7

a) DIT algorithm

b) Architecture of Digital Signal Processor

c) Design of linear phase FIR filter

d) Physical significance of Z-transform.