

**B.E. (IT) Part-III 6th Semester Examination, 2010**  
**Digital Signal Processing**  
**(IT-604)**

**Time : 3 hours**

**Full Marks : 70**

Answer any FIVE questions.

Find **z-Transform** with the ROC for each of the following sequences,

a)  $x(n] = \frac{(n-1)}{2} + \frac{(-1)^n}{4}$

b)  $x(n] = \frac{(n+1)(n+2)(n+3)}{3!} a^n$  for  $n > 0$

c)  $y(n] = x(n] + 3x(n-1] + 2x(n-2])$ ; find  $H(z)$

**5 + 5 + 4 = 14**

2. a) Find the magnitude/phase response of the following signal  $h[n]$ ,



0 N-; n

b) What is an all-pass system? A system is represented by the following equation. State whether the system is all pass system.

$H(z) = A$

**7 + 7 = 14**

3. a) Draw the **parallel form structure** of the following system. State the computational complexity of the design. Is your design an optimized one?

$$H(z) = \frac{0.44z^3 + 0.362z^2 + 0.02z}{1 + 0.4z^{-1} + 0.18z^{-2} - 0.2z^{-3}}$$

b) Draw signal flow graph of a second order digital IIR filter along with the block-diagram realization of the filter.

**8 + 6 = 14**

4. a) Realize the following linear phase FIR system,

$$3 \quad 8 \quad 3$$

- b) The  $k$  parameters for an all-zero lattice structure are given as  $k_1 = 2/7$ ,  $k_2 = 1/8$ . Design the lattice structure. Find its order and transfer function.  
 c) Discuss how finite register length affects IIR and FIR filter design.

$$5 + 4 + 5 = 14$$

5. a) Describe digital IIR filter design by "*Bilinear transformation*" method.  
 b) What is frequency warping?

- c) Convert the analog *filter* with system function  $H(s) = \frac{s^2 + 16}{(s^2 + 8s + 16)}$  to a

digital IIR filter by means of the bilinear transformation. The digital filter is to have a resonant frequency of  $\omega = \pi/2$ .

$$8 + 2 + 4 = 14$$

6. a) Perform N-point DFT of the sequence  $x(n) = a^n$ ;  $0 < a < 1$ .  
 b) State computational complexity of N-point DFT.  
 c) Perform radix-2 DITFFT algorithm on a discrete 8-point sequence and draw the butterfly diagram for the FFT. Also find computational complexity in each stage of the design?

$$3 + 2 + 9 = 14$$

7. a) Perform circular convolution of the two given sequences,  $x(n) = \{1, 2, 2, 1\}$  and  $h(n) = \{2, 1, 1, 2\}$ .  
 b) Describe the CORDIC algorithm for realizing the angle  $3(T)$ . You are supplied with the look-up table for arc-tangent values with maximum shift sequence  $i = 15$ .

$$6 + 8 = 14$$