## GUJARAT TECHNOLOGICAL UNIVERSITY ME Semester –II Examination Dec. - 2011

## Subject code: 1720702 Subject Name: Digital Signal Processing Time: 02.30 pm – 05.00 pm

Date: 12/12/2011

**Total Marks: 70** 

**Instructions:** 

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Explain the term linearity, causality, stability, time 07 invariance with respect to discrete time systems. Give example of each with explanation.
  - (b) Determine the impulse response of system described by the 07 second order difference equation y(n) 4y(n-1) + 4y(n-2) = x(n) x(n-1).
- Q.2 (a) Define and explain the terms (i) cross correlation and (ii) 07 autocorrelation of discrete sequences. Also obtain cross correlation of the following sequences x1(n) = {...,0,0,2,-1,3,7,1,2,-3,0,0,....} ↑
  and x2(n) = {...,0,0,1,-1,2,-2,4,1,-2,5,0,0,....}
  ↑
  - (b) Define z-transform. Explain and prove the following 07 properties of Z-transform. (1) Time shifting (2) Time reversal.
    - OR

(b) Determine Z-transform and ROC of following signals. 07 (a)  $x(n) = [3(2^n) - 4(3^n)]$ (b)  $x(n) = (\frac{1}{2})^n u(n)$ .

Q.3 (a) Determine inverse Z-transform by partial fraction 07 expansion method.

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

If (a) ROC: 
$$|z| > 1$$
 (b) ROC:  $|z| < 0.5$  (c) ROC:  $0.5 < |z| < 1$ 

(b) A linear time-invariant system is characterized by the 07 system function

$$H(z) = \frac{3 - 4z^{-1}}{1 - 3.5z^{-1} + 1.5z^{-2}}$$

Specify the ROC of H(z) and determine h(n) for following conditions:

- (a) The system is stable .
- (b) The system is causal.
- (c) The system is anticausal.

ORQ.3 (a) Explain lattice ladder structure for FIR filters.07(b) Determine the direct form II realization for each of the  
following LTI systems.  
(a) 
$$2y(n) + y(n-1) - 4y(n-3) = x(n) + 3x(n-5)$$
  
(b)  $y(n) = x(n) - x(n-1) + 2x(n-2) - 3x(n-4)$ 07Q.4 (a) Describe fully Radix-2 DIF FFT algorithm. Write  
necessary equations and draw the flow diagram for N = 8  
(b) By means of the DFT and IDFT, determine the response of  
the FIR filter with impulse response  $h(n) = \{1, 2, 3\}$   
To the input sequence  $x(n) = \{1, 2, 2, 1\}$   
To the input sequence  $x(n) = \{1, 2, 2, 1\}$   
f1Q.4 (a) Explain the differences between FIR and IIR Filters and  
mention their advantages and disadvantages.  
(b) Convert the analog filter with the system function  
 $H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16}$   
Into a digital filter by means of the bilinear transformation.  
The digital filter is to have a resonant frequency of  $\omega_r = \pi/2$ .07Q.5 (a) Perform the circular convolution of following two  
sequences:  $x1(n) = \{2, 1, 2, 1\}$  &  $x2(n) = \{1, 2, 3, 4\}$   
f107Q.5 (a) Explain architecture of general purpose digital signal  
processor.  
(b) Explain the application of DSP in voice processing.07

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