Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 712601N

Subject Name Digital Signal Processing Algorithm and Processor Architecture

Date: 31/ 01 /2011 **Time: 02.30 pm – 05.00 pm**

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)** Answer the following**(Any Two)** **07**

(i)Show that the accumulator is a time invariant system while the compressor is not.

(ii) An impulse input to an accumulator yields a unit step output and the backward difference system cascaded to it serves the function of an inverter. Justify

(iii) Draw the block diagram of VLIW architecture and list out its advantages and disadvantages

(b) (i)Find the impulse response and frequency response of a second order system described by difference equation **07**

$$y(n)-y(n-1)+\frac{3}{16}y(n-2)=x(n)-\frac{1}{2}x(n-1)$$

(ii)Discuss the region of convergence for Z Transform with relevant sketches and illustrations for right sided ,left sided and left sided sequences

Q.2 **(a)** Prove (i) $F[nx(n)]=j\frac{dX(\omega)}{d(\omega)}$ **07**

(ii) $\text{DFT}\{x((n-l))_N\}=X(K)e^{-j\frac{2\pi kl}{N}}$

(b) Find (i) DFT X(k) of the sequence $x(n)=\{1,1,0,0\}$ and **07**
(ii) IDFT of $Y(k)=\{1,0,1,0\}$

OR

(b) Design a low pass filter with 11 coefficients for the specifications: **07**
Passband frequency edge =0.25KHz,
Sampling Frequency=1KHz .Use Hamming Window.

Q.3 **(a)** Find Z Transform of the following discrete time signals and find R.O.C for each: **07**

(i) $x(n)=\left(\frac{1}{3}\right)^{n-1}u(n-1)$ (ii) $x(n)=r^n(\cos\omega_0 n)u(n)$

(b) Realize the system function of FIR filter **07**

$$H(z)=1+\frac{1}{3}z^{-1}+\frac{1}{4}z^{-2}+\frac{1}{4}z^{-3}+\frac{1}{3}z^{-4}+z^{-5}$$

by linear phase structure and compare it with direct form realization of this FIR filter

OR

Q.3 **(a)** Prove that for a highpass filter,the unit sample response is **07**

$$h_d(n) = -2f_c \frac{\sin(nw_c)}{nw_c}$$

(b) For the sequences $x(n) = \{1,2,3,0\}$ and $y(n) = \{1,1,-1,1\}$.Use DIF algorithm to obtain X(k) and Y(k) ,Draw the signal flow graphs. **07**

Q.4 **(a)** For the sequences $x(n) = (1,2,-1,2,3,-2,-3,-1,1,1,2,-1)$ and $h(n) = (1,2)$, compute the output sequence using overlap add method. **07**

(b) Explain the following: **07**

(i) Goertzel algorithm

(ii) 2 StageLattice structure for FIR filter

OR

Q4 **(a)** What is linear filtering?How is it performed?Discuss step by step procedure of overlap save method **06**

(b) Obtain the system function H(Z) for the system described by the difference equation, **07**

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

Realize the filter using (i) Direct Form I and II(ii) Direct Form II and its transposed form(iii)Cascade form (iv) Parallel Form for all cases, draw the structures neatly with system equations at different points

Q.5 **(a)** Explain the design of IIR filter using Bilinear transformation method and discuss its advantages over other design methods Discuss the stability aspects and frequency warping **07**

(b) Given $x(n) = \{1,2,3,4\}$ find DFT X(K) using DIT FFT algorithm. Also find its IDFT .Draw the flow graphs and tabulate the values of the output at all stages for both cases. **07**

OR

Q.5 **(a)** (i)Draw the block diagram of architecture of TMS320C5X . **07**
DSP and briefly explain the function of all elements.

(b) Perform circular convolution of the two sequences $x_1(n) = \{1,2,2,1)\}$ and **07**

$x_2(n) = \{1,2,3,1\}$

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