Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 712601N **Date: 11/02/2012**

Subject Name: Digital Signal Processing Algorithm and Processor Architecture

Time: 10.30 am – 01.00 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)** Define the following with respect to discrete time system with an illustration:(i) Time invariant system (ii) Memoryless System. **02**

(b) Explain any two properties of DFT. **05**

(c) Realize linear phase FIR structure for **03**

$$H(z) = 1 + \frac{1}{2}Z^{-1} + \frac{1}{8}Z^{-2} + \frac{3}{4}Z^{-3} + \frac{1}{8}Z^{-4} + \frac{1}{2}Z^{-5} + Z^{-6}$$

(d) Find x(n) * h(n) for sequences x(n)={1,2,1,1} and h(n)={1,-1,0,0,1,1} **04**

↑ ↑

Q.2 **(a)** Find the circular convolution of the two sequences $x_1(n)=\{1,-1,-2,3,-1\}$ and $x_2(n)=\{1,2,3)$ using concentric circle method and verify by the matrix method **07**

(b) (i)Determine the causal signal x(n) for **07**

$$X(Z) = \frac{Z^2 + Z}{\left(Z - \frac{1}{2}\right)^2 \left(Z - \frac{1}{4}\right)}$$ (Partial Fraction Method) (ii) Find Z transform of $x(n) = a^n \sin \omega_0 n$

OR

(b) Determine:(i)Fourier transform of $y(n) = \frac{1}{2}\left(x(n) + x(n-2)\right)$ and obtain its magnitude response. **07**

(ii) Cross-correlation of the sequences

x(n) = {1,2,1,1} and y(n)={1,0,0,1}

↑ ↑

Q.3 **(a)** Determine the zero input response of the system described by the homogeneous second order difference equation given by **07**

$y(n) - 5y(n-1) + 6y(n-2) = 0$ for $y(-1) = 2, y(-2) = 0$

(b) Do as directed using the direct formula (Any two): **07**

(i) Find DFT of the sequence x(n) = {1,1,0,0}

(ii) Find IDFT of Y(K) = { 1,0,1,0 }

(iii) Find DCT of the data sequence x(n) = {1,2,0,3}

OR

Q.3 **(a)** Realize the following IIR system by Direct Form II and cascade form for the system described by: **07**

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

(b) Find the FFT of the sequence x(n)={1,-1,-1,-1,1,1,1,-1} by DIT FFT algorithm using the flow graph. **07**

Q.4 **(a)** Explain Goertzel algorithm for linear filtering operation. **04**

(b) Show the procedure for the design of FIR filter using Kaiser window. **04**

(c) Find the output y(n) of the filter whose impulse response is h(n)={1,1,1}and input signal x(n) ={3,-1,0,1,3,2,0,1,2,1} using overlap save method. **06**

OR

Q.4 **(a)** Determine the lattice coefficient corresponding to the FIR filter with the system function, $H(Z) = 1 + \frac{13}{24}Z^{-1} + \frac{5}{8}Z^{-2} + \frac{1}{3}Z^{-3}$ **04**

(b) Explain any one method of IIR filter design. **06**

(c) Explain the stability of second order system with the help of stability triangle and obtain the conditions. **04**

Q.5 **(a)** Show that the impulse response for a bandpass FIR filter is **04**

$$h(n) = 2f_{c_1}\frac{\sin(n\omega_{c_1})}{n\omega_{c1}} - 2f_{c_2}\frac{\sin(n\omega_{c_2})}{n\omega_{c_2}}$$

(b) Draw the block diagram and Explain the following with respect to TMS 320C5x architecture: **07**

(i) Bus structure
(ii) Functional units of CALU of 5X
(iii) Registers of ARAU
(iv) Interrupt types supported

(c) Show that signal energy $E_x = \sum_{n=-\infty}^{n=\infty}|x(n)|^2 = \frac{1}{2\pi}\int_{-\pi}^{\pi} S_{xx}(\omega)d\omega$

OR

Q.5 **(a)** Find the FFT of the 4 point sequence $x(n) = \cos\frac{n\pi}{2}$ by DIF FFT algorithm. **05**

(b) Explain the pipeline operation of TMS 320C54X. **04**

(c) Explain the basic architecture for (i) an FIR digital filter (ii) IIR filter using blocks of individual components. **05**

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