Code No: R05320201 **Set No. 1**

III B.Tech II Semester Regular Examinations, Apr/May 2008
DIGITAL SIGNAL PROCESSING
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering, Electronics & Telematics and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and prove the basic properties of discrete time systems?
   (b) A discrete time LTI system has impulse response h(n)={1, 3, 2, -1, 1} for $-1 \leq n \leq 3$. Using linearity and time invariance property, determine the system output y(n) if the input x(n) is given by x(n) = 2δ(n)-δ(n-1). [16]

2. (a) Define DFT of a sequence x(n). Obtain the relationship between DFT and DTFT.
   (b) Consider a sequence $x(n) = \{2, -1, 1, 1\}$ and T = 0.5 compute its DFT and compare it with its DTFT. [8+8]

3. An 8 point sequence is given by x(n) = {2,2,2,2,1,1,1,1}. Compute 8 point DFT of x(n) by
   (a) radix - 2 D I T F F T
   (b) radix - 2 D I F FF T
   Also sketch magnitude and phase spectrum. [16]

4. (a) An LTI system is described by the equation y(n)=x(n)+0.81x(n-1)-0.81x(n-2)-0.45y(n-2). Determine the transfer function of the system. Sketch the poles and zeroes on the Z-plane.
   (b) Define stable and unstable system. Test the condition for stability of the first-order IIR filter governed by the equation y(n)=x(n)+bx(n-1). [8+8]

5. (a) Explain difference between frequency responses of analog LPF and digital LPF.
   (b) Convert the analog transfer function
   H(s) = 1/(s + 1) (s +2)
   Find H(Z) using Impulse Invariant method , also check stability of this filter.
   Assume T = 1sec. [6+10]

6. (a) Describe the FIR filter characteristics in time domain.
   (b) Determine the frequency response of a linear phase FIR filter given by
   $y(n) = A_1x(n) + A_2x(n-1) + A_3x(n-2) + A_2x(n-3) + A_1x(n-4)$. [6+10]

7. Consider the signal x(n) = n u(n)

(a) Determine the spectrum of a signal.

(b) The signal is applied to a decimator that reduces sampling rate by a factor by '3'. Determine its output spectrum.

(c) Show that the spectrum in part (ii) is simply Fourier transform of x(3n). [16]

8. (a) What are the advantages of DSP processors over conventional microprocessors?

(b) Explain the Implementation of convolver with single multiplier/adder. [8+8]

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Code No: R05320201 **Set No. 2**

III B.Tech II Semester Regular Examinations, Apr/May 2008
DIGITAL SIGNAL PROCESSING
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering, Electronics & Telematics and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find the inverse DTFT of $X\left(e^{jw}\right) = \frac{1}{1-\frac{1}{3}e^{j10w}}$
   (b) Find a difference equation to implement a filter that has a unit sample response $h\left(n\right) = \left(\frac{1}{4}\right)^n \cos\left(\frac{x\pi}{3}\right).u\left(n\right)$. [16]

2. (a) Define DFT of a sequence. Compute the N - point DFT of the sequence. $X(n) = Cos(2\pi rn/N), 0 \leq n \leq N-1$ and $0 \leq r \leq N-1$
   (b) Explain how DFT can be obtained by sampling DFS for a given sequence. [8+8]

3. (a) Explain the inverse FFT algorithm to compute inverse DFT of a N=8. Draw the flow graph for the same.
   (b) Compute the FFT for the sequence { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]

4. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$
   (b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find
      i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
      ii. The unit sample response of the system.
      iii. Is this system stable or not? [6+10]

5. (a) Describe digital IIR filter characterization in Z ? domain.
   (b) Find H(Z) using Impulse Invariant method for given analog system. H(s) = 1/(s + 0.5) (s^2 +0.5s+2) [6+10]

6. (a) Describe the FIR filter characteristics in time domain.
   (b) Determine the frequency response of a linear phase FIR filter given by $y(n) = A_1x(n) + A_2x(n-1) + A_3x(n-2) + A_2x(n-3) + A_1x(n-4)$. [6+10]

7. With the help of block diagram explain the sampling rate conversion by a rational factor 'I/D'. Obtain necessary expressions. [16]

8. Discuss various interrupt types supported by TMS320C5X processor. [16]

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Code No: R05320201 **Set No. 3**

III B.Tech II Semester Regular Examinations, Apr/May 2008
DIGITAL SIGNAL PROCESSING
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering, Electronics & Telematics and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find the convolution of the given two signals:
graphically: x(n)=u(n)-u(n-5)
h(n)=2[u(n)-u(n-3)]
(b) Verify the result of part(a) by evaluating directly the convolution sum. [16]

2. (a) Compute Discrete Fourier transform of the following finite length sequence considered to be of length N.
i. $x(n) = \delta(n + n_0)$ *where* $0 < n_0 < N$
ii. $x(n) = a^n$ *where* $0 < a < 1$.
(b) If x(n) denotes a finite length sequence of length N, show that $x((-n))_N = x((N - n))_N$. [8+8]

3. (a) Implement the decimation in time FFT algorithm for N=16.
(b) In the above Question how many non - trivial multiplications are required. [10+6]

4. (a) Determine the frequency response , magnitude response and phase response for the system given by $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) - x(n-1)$
(b) A causal LTI system is described by the difference equation y(n)=y(n-1)+y(n-2)+x(n-1), where x(n) is the input and y(n) is the output. Find
i. The system function H(Z)=Y(Z)/X(Z) for the system, plot the poles and zeroes of H(Z) and indicate the region of convergence.
ii. The unit sample response of the system.
iii. Is this system stable or not? [6+10]

5. Convert analog filter with transfer function
(s + 0. 1)/ (s + 0.1)^2+ 9
Into digital IIR filter using Impulse Invariant method. Also sketch response and comment on 'T' value how it affects aliasing. [16]

6. Design high pass linear phase filter with frequency response

$H_d(e^{j\omega}) = e^{-j2\omega no}$ $\omega_c \leq |\omega| \leq \pi$
$= 0$ otherwise
For N=7 and $\omega_c = \pi/4$ use

(a) Rectungular window

(b) Hamming Window. [16]

7. (a) Consider a signal x(n) = u(n)
   i. Obtain a signal with a decimation factor '3'
   ii. Obtain a signal with a interpolation factor '3'.

   (b) Consider a signal x(n) = Sinπn. u(n)
   i. Obtain a signal with a decimation factor '2'
   ii. Obtain a signal with a interpolation factor '2'. [6+10]

8. (a) What are the advantages of DSP processors over conventional microprocessors?

   (b) Explain the Implementation of convolver with single multiplier/adder. [8+8]

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Code No: R05320201 **Set No. 4**

III B.Tech II Semester Regular Examinations, Apr/May 2008
DIGITAL SIGNAL PROCESSING
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Electronics & Instrumentation Engineering, Electronics & Control Engineering, Electronics & Telematics and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the following terms as referred to LTI discrete time system:
   i. Stability
   ii. Causality
   iii. Time invariance
   iv. Linearity.
   (b) Determine whether the following system is
   i. Linear
   ii. Causal
   iii. Stable
   iv. Time invariant
   $y(n) = \log_{10}|x(n)|$
   Justify your answer. [16]

2. (a) Define DFT of a sequence x(n). Obtain the relationship between DFT and DTFT.
   (b) Consider a sequence $x(n) = \{2, -1, 1, 1\}$ and T = 0.5 compute its DFT and compare it with its DTFT. [8+8]

3. (a) Implement the decimation in time FFT algorithm for N=16.
   (b) In the above Question how many non - trivial multiplications are required. [10+6]

4. (a) Explain how the analysis of discrete time invariant system can be obtained using convolution properties of Z transform.
   (b) Determine the impulse response of the system described by the difference equation y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1) using Z transform. [8+8]

5. (a) Describe digital IIR filter characterization in Z ? domain.
   (b) Find H(Z) using Impulse Invariant method for given analog system.
   H(s) = 1/(s + 0.5) (s^2 +0.5s+2) [6+10]

6. (a) Describe the FIR filter characteristics in time domain.

(b) Determine the frequency response of a linear phase FIR filter given by $y(n) = A_1x(n) + A_2x(n-1) + A_3x(n-2) + A_2x(n-3) + A_1x(n-4)$. [6+10]

7. (a) Discuss the applications of Multirate Digital Signal Processing.

   (b) Describe the decimation process with a factor of ' M '. Obtain necessary expression. [8+8]

8. (a) What are the advantages of CISC?

   (b) What are the advantages of RISC? [16]

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