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

III B.Tech Supplimentary Examinations, Aug/Sep 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) The DTFT of $x(n) = \left(\frac{1}{5}\right)^n$ u(n+2) in $X(e^{jw})$, find the sequence that has a DTFT given by $y(e^{jw}) = X(e^{j2w})$
   (b) A causal LTI system is defined by the difference equation 2y(n)-y(n-2)=x(n-1)+3x(n-2)+2x(n-3). Find the frequency response $H(e^{jw})$, magnetude response and phase response. [16]

2. (a) If x(n) is a periodic sequence with a period N, also periodic with period 2N. $X_1(K)$ denotes the discrete Fourier series coefficient of x(n) with period N and $X_2(k)$ denote the discrete Fourier series coefficient of x(n) with period 2N. Determine $X_2(K)$ in terms of $X_1(K)$.
   (b) Prove the following properties.
      i. $W_N^n x(n) \rightarrow X((K+1))_N R_N(K)$
      ii. $x*(n) \rightarrow X*((-K))_N R_N(K)$ [8+8]

3. (a) Draw the butterfly line diagram for 8 - point FFT calculation and briefly explain. Use decimation -in-time algorithm.
   (b) What is FFT? Calculate the number of multiplications needed in the calculation of DFT using FFT algorithm with 32 point sequence. [8+8]

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) Justify the statement IIR filter is less stable and give reasons for it.
   (b) Find filter order for following specifications
   $\sqrt{0.5} \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq \pi/2$
   $| \qquad H(e^{j\omega})| \leq 0.2 \qquad 3\pi/4 \leq \omega \leq \pi$
   With T = 1 sec. use Impulse Invariant method. [8+8]

6. (a) What is an FIR filter ? Compare an FIR filter with an IIR filter.
   (b) Discuss frequency sampling method for an FIR filter design . [8+8]

7. Design one stage and two stage interpolators to meet following specifications.

   I = 20

   (a) Pass band : $0 \leq F \leq 90$
   (b) Transition band : $90 \leq F \leq 100$
   (c) Input sampling rate : 10,000HZ
   (d) Ripple : $\delta_1 = 10^{-2}$, $\delta_2 = 10^{-3}$. [16]

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

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

III B.Tech Supplimentary Examinations, Aug/Sep 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) Let x(n) be the sequence
x(n)=δ(n+1)-δ(n)+2δ(n-1)+3δ(n-2) which has a DTFT $X\left(e^{jw}\right) = X_R\left(e^{jw}\right) + jX_I\left(e^{jw}\right)$
where $X_R\left(e^{jw}\right)$ *and* $X_I\left(e^{jw}\right)$ are the real part and the imaginary part of $X\left(e^{jw}\right)$, respectively. Find the sequences y(n) that has a DTFT given by
$y\left(e^{jw}\right) = X_I\left(e^{jw}\right) + jX_R\left(e^{jw}\right).e^{j2w}$
(b) Let x(n) be a sequence with a DTFT $X\left(e^{jw}\right)$. Find the DTFT of $x\left(n\right) * x^*\left(-n\right)$ in terms of $X\left(e^{jw}\right)$. [16]

2. (a) Compute the discrete Fourier transform of each of the following finite length sequences considered to be of length N.
   i. $x(n) = \delta(n)$
   ii. $x(n) = \delta(n - n_0)$ where $0 < n_0 < N$
   iii. $x(n) = a^n$ $0 \le n \le N-1$
   (b) Let $x_2(n)$ be a finite duration sequence of length N and $x_1(n) = \delta(n - n_0)$ where $n_0 < N$. Obtain the circular convolution of two sequences. [8+8]

3. (a) Draw the butterfly line diagram for 8 - point FFT calculation and briefly explain. Use decimation -in-time algorithm.
   (b) What is FFT? Calculate the number of multiplications needed in the calculation of DFT using FFT algorithm with 32 point sequence. [8+8]

4. (a) With reference to Z-transform, state the initial and final value theorem.
   (b) Determine the causal signal x(n) having the Z-transform $X(Z) = \frac{Z^2+Z}{\left(Z-\frac{1}{2}\right)^2\left(Z-\frac{1}{4}\right)}$. [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 a band stop filter with desired frequency response
$H_d(e^{j\omega}) = e^{-j2\omega no}$
$-\omega_{c1} \le \omega \le \omega_{c2}$
& $\omega_{c2} \le |\omega| \le \pi$

$= 0$ otherwise

Design a filter for N = 7 and cutoff frequency $\omega_{c1}=\pi/4$ and $\omega_{c2}= 3\pi/4$ Using

(a) Rectangular window.

(b) Bartlett window. [16]

7. (a) Explain Multirate Digital Signal Processing.

   (b) Consider ramp sequence and sketch its interpolated and decimated versions with a factor of '3'. [6+10]

8. What are the on chip peripherals available on programmable Digital signal processors and explain their functions? [16]

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

III B.Tech Supplimentary Examinations, Aug/Sep 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) What is " padding with Zeros ", explain with an example, Explain the effect of padding a sequence of length N with L Zeros (or frequency resolution).
   (b) Compute the DFT of the three point sequence $x(n) = \{2, 1, 2\}$. Using the same sequence, compute the 6 point DFT and compare the two DFTs. [8+8]

3. (a) Let x(n) be a real valued sequence with N-points and Let X(K) represent its DFT , with real and imaginary parts denoted by $X_R(K)$ and $X_I(K)$ respectively. So that X(K) = $X_R(K) + JX_I(K)$. Now show that if x(n) is real, $X_R(K)$ is even and $X_I(K)$ is odd.
   (b) Compute the FFT of the sequence x(n) = { 1, 0, 0, 0, 0, 0, 0, 0 } [8+8]

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) What is frequency warping ? How it will arise.
   (b) Compare Impulse invariant and bilinear transformation methods. [8+8]

6. Find frequency response of Hamming window and also find different parameters from it. [16]

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

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

III B.Tech Supplimentary Examinations, Aug/Sep 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) Determine the impulse response and step response of the causal system given below and discuss on stability:
y(n)+y(n-1)-2y n(-2)=x(n-1)+2x(n-2)
   (b) Prove that impulse response of an LTI system is absolutely summable for stability of the system. [16]

2. (a) Compute the discrete Fourier transform of each of the following finite length sequences considered to be of length N.
      i. $x(n) = \delta(n)$
      ii. $x(n) = \delta(n - n_0)$ where $0 < n_0 < N$
      iii. $x(n) = a^n$ $0 \leq n \leq N - 1$
   (b) Let $x_2(n)$ be a finite duration sequence of length N and $x_1(n) = \delta(n - n_0)$ where $n_0 < N$. Obtain the circular convolution of two sequences. [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) 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. If the specifications analog low pass filter are to have a 1 dB attenuation at cutoff frequency of 1KHZ and maximum stop band ripple $\delta_s = 0.01$ for |f| > 5KHZ , determine required filter order
   (a) Butterworth
   (b) Type - I Chebyshev
   (c) Type- II Chebyshev. [16]

6. (a) Explain FIR filter design using windowing method.
   (b) Find the frequency response of an rectangular window. [8+8]
7. (a) Explain Multirate Digital Signal Processing.
   (b) Consider ramp sequence and sketch its interpolated and decimated versions with a factor of '3'. [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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