Code.No: 07A6EC01 | R07 | SET-1

III B.TECH – II SEM EXAMINATIONS, DECEMBER - 2010
DIGITAL SIGNAL PROCESSING
(COMMON TO EEE, ECE, EIE, E.CON.E, ETM, ICE)

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

Answer any FIVE questions
All questions carry equal marks

- - -

1.a) Check whether the following systems are stable, causal.

i) $h(n) = e^{an}\,u(n)$ ii) $h(t) = e^{-at}\cos bt\,u(t)$

iii) $h(t) = te^{at}\,u(t)$ iv) $h(n) = e^{n/2}\,u(n-4)$

b) Find the natural response of the system described by the difference equation $y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n) - x(n-1)$ whose initial conditions are $y(-1) = 1$, $y(-2) = 1$. [8+8]

2. Find the Fourier series coefficients of the signal given $z(n) = x(n) \times y(n)$ where

$x(n) = 1 + \sin\left(\frac{2\pi n}{3} + \frac{\pi}{2}\right)$

$y(n) = \cos\left(\frac{2\pi n}{3} + \frac{\pi}{2}\right)$

Assume N=4.

a) Obtain the output z(n). Using multiplication property.
b) Compare the result of part (a) with direct calculation. [8+8]

3.a) Find the IDFT for the following coefficients using DIF FFT.

$X(k) = \{38,\ -5.828 + j6.07,\ j6,\ -0.172 + j8.07,\ -10,\ -0.172 - j807,\ -j6,\ -5.828 - j6.07\}$

b) Explain the procedure for calculating FFT for composite N. [10+6]

4.a) Find the inverse Z-transform of $X(Z) = \frac{1}{1 - \frac{1}{6}z^{-1} - \frac{1}{3}z^{-2}}$ using convolution method.

b) Obtain the cascade realization of the system described by difference equation.

$y(n) + \frac{1}{6}y(n-1) + \frac{1}{6}y(n-2) - \frac{1}{24}y(n-3) - \frac{1}{16}y(n-4)$

$= x(n) + \frac{5}{6}x(n-1) + x(n-2) + \frac{13}{36}x(n-3) + \frac{1}{6}x(n-4)$ [8+8]

5.a) Design a digital chebyshev type-1 band pass filter with following specification:

$$\left|H\left(e^{j\omega}\right)\right| = \begin{cases} -3dB, & 0.55\pi \le \omega \le 0.65\pi \\ -15dB, & 0 \le \omega \le 0.1\pi \quad and \quad 0.95\pi \le \omega \le \pi \end{cases}$$

Using Bilinear transformation.

b) Explain about the characteristics of Butterworth filter. [12+4]

6.a) Analyse the case of symmetric impulse response with odd length for FIR filter to have linear phase.

b) Explain in detail the comparison of different windows on FIR filter design. [8+8]

7.a) Give the frequency domain analysis of Decimator.

b) Explain how to implement Multirate filter using poly phase decomposition. [8+8]

8.a) Compare DSP processors and microprocessors.

b) Explain different types of addressing modes in TMS 320C5X processors. [8+8]

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DIGITAL SIGNAL PROCESSING
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Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

1.a) Find the forced response of the system described by the difference equation $y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n) - x(n-1)$ when input signal is $x(n) = 2^n u(n)$.

b) Define the following for LTI system.
i) Causality ii) Stability iii) Invertibility [8+8]

2.a) Find the circular convolution of the given data sequence $x_1(n) = \{1,3,5,7\}$ & $x_2(n) = \{2,4,6,8\}$ using DFT. & IDFT method.

b) Find the discrete-time fourier series coefficients for $x(n) = 1 + \sin\left(\frac{2\pi}{N}\right)n + \cos\left(\frac{2\pi}{N}\right)n + 2\cos\left(\frac{6\pi}{N}\right)n + 3\sin\left(\frac{8\pi}{N}n + \frac{\pi}{3}\right)$. [8+8]

3.a) Determine the DFT of the sequence $x(n) = \{2,1,4,6,5,8,3,9\}$ using DIT FFT.

b) Explain the advantages of FFT algorithm over DFT method. [8+8]

4.a) Determine the Z-transform of the signal $x(n) = a^n u(n) - b^n u(n)$. $b > a$ and plot the ROC.

b) State & prove multiplication property of Z-transform. [8+8]

5.a) Prove that the cut off frequency of Butterworth filter (Low pass) is $\Omega_C = \frac{\Omega_\rho}{\left(10^{0-1\alpha_\rho} - 1\right)^{1/2N}} = \frac{\Omega_s}{\left(10^{0.1\alpha_s} - 1\right)^{1/2N}}$.

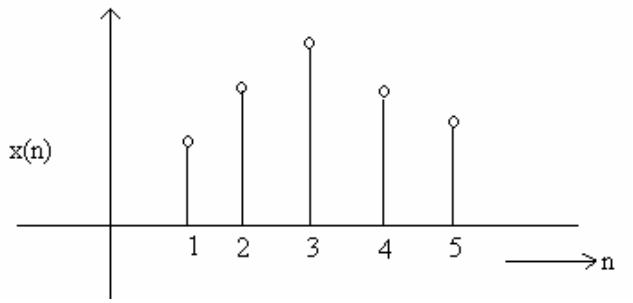
b) Compare IIR & FIR filters. [8+8]

6.a) Obtain the cascade form realization of the given non-recursive filter $H(z) = 1 + 8z^{-1} + 21z^{-2} + 35z^{-3} + 28z^{-4} + 15z^{-5}$.

b) Explain how to design FIR filter using frequency sampling technique. [8+8]

7.a) Draw the block diagram of sampling rate converter by a factor I/D & explain.

b) Demonstrate the effect of increasing sampling rate by a factor 2 for the signal below [8+8]



8.a) Explain the bus structure of TMS320C5X processor.

b) Explain different registers used in TMS320C5X processor. [8+8]

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DIGITAL SIGNAL PROCESSING
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Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

- - -

1.a) Perform the convolution of the given data sequences $x(n)=\{1,-2,3,-2\}$, $h(n)=\{2,-3,4\}$

b) Check whether the following systems are stable causal or not.

i) $h_1(n)=3^n u(-n)$ ii) $h_2(n)=e^{n/2}u(n-4)$

iii) $h_3(n)=e^{-2|n|}$. [8+8]

2.a) Explain the dirichlets conditions for existence of fourier series.

b) Consider a discrete-time LTI system with difference equation $y(n)-\frac{1}{3}y(n-1)=x(n)$

Find the fourier series representation of the output y(n) for the input $x(n)=\cos\left(\frac{2\pi}{5}n\right)$ [8+8]

3.a) Find the circular convolution of given data sequences $x_1(n)=\{1,3,5,7\}$ & $x_2(n)=\{2,4,6,8\}$ using matrix method.

b) Determine the DFT of the sequence $x(n)=\{2,1,4,6,5,8,3,9\}$ using DIFFFT. [8+8]

4.a) Find the inverse Z-transform of $x(z)=\frac{1+z^{-1}}{1-\frac{1}{5}z^{-1}}$ using long division method when

$|z|>1/5$.

b) Give the realizbile direct form structure for the linear phase FIR system given by

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

5.a) Explain in detail the Bilinear transformation technique in IIR filter design.

b) Design a digital low pass Butterworth filter using bilinear transformation, if pass band & stop band cut off frequencies are 800 rad/sec & 1800 rad/sec respectively. The pass band attenuation is -3dB and stop band attenuation is -10dB. [8+8]

6.a) Discuss various advantages and disadvantages of Kaiser window technique with other windowing methods.

b) Design an ideal HPF whose desired frequency response is

$$H_d\left(e^{j\omega}\right)=\begin{cases}1, & \pi \geq|\omega|\geq \dfrac{\pi}{3}\\ 0, & otherwise\end{cases}$$

using Hamming window. for N = 5 [8+8]

7.a) Give the mathematical analysis of Decimator.

b) Explain how to implement polyphase filter structure for multirate filters. [8+8]

8.a) Compare microprocessors and DSP processors.

b) Explain the concept of pipelining in DSP processors. [8+8]

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III B.TECH – II SEM EXAMINATIONS, DECEMBER - 2010
DIGITAL SIGNAL PROCESSING
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Time: 3hours **Max.Marks:80**

Answer any FIVE questions
All questions carry equal marks

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1.a) Find the system response described by the difference equation $y(n)-\frac{7}{12}y(n-1)+\frac{1}{12}y(n-2)=2, n\geq 0$
The initial conditions are $y(-1)=2$ *and* $y(-2)=3.$
b) Define a linear shift invariant system. [8+8]

2. Find the Fourier series coefficients of the signal $2(n)=x(n)\times y(n)$ where $x(n)=1+\sin\left(\frac{2\pi}{3}n+\frac{\pi}{2}\right)$ and $y(n)=\cos\left(\frac{2\pi}{3}n+\frac{\pi}{3}\right)$. Assume N = 4 with direct calculation and using multiplication property and compare the results. [8+8]

3.a) Determine the inverse DTFT of $X\left(e^{j\omega}\right)=\begin{cases}1, & |\omega|\leq\omega_1\\ 0, & \omega,<|\omega|<\pi\end{cases}$.
b) Determine the DFT of the sequence $x(n)=\{-1,2,-3,4,9,-20,12,6\}$ using DITFFT. [8+8]

4.a) Determine the response of the system. Whose linear constant coefficient difference equation is given by $y(n)-0.1y(n-1)-0.12y(n-2)=x(n)-0.4x(n-1)$ if $y(-1)=y(-2)=2$ and $x(n)=(0.4)^n x(n)$ using z-transform.
b) Obtain the parallel realization of the system described by the difference equation
$y(n)-\frac{13}{12}y(n-1)+\frac{9}{24}y(n-2)\frac{-1}{24}y(n-3)=x(n)+2x(n-1)$ [8+8]

5. Design a chebyshev Type -1 band reject filter for the following specs.
$\alpha_\rho=-2dB,\ \alpha_s=-10dB,\ T=1\text{sec}.$ Pass band frequency is $0\leq\omega\leq 0.07\pi$ and $0.8\pi\leq\omega\leq\pi.$ Stop band frequency is $0.2\pi\leq\omega\leq 0.3\pi$. Use Impulse-Invariant transformation. [8+8]

6.a) Design an ideal Hilbert transform with frequency response $H\left(e^{jw}\right)=\begin{cases}-j, & \pi>\omega\geq 0\\ j, & 0>\omega\geq-\pi\end{cases}$
using rectangular window for N = 9.
b) Compare FIR & IIR filters. [8+8]

7.a) For the sequence $x(n)=\{5,6,8,4,2,1,3,12,10,7,11\}$ find the output sequence y(z) which is down sampled version of x(n) by 2.
b) Give the frequency domain analysis of Interpolator. [8+8]

8.a) Explain the special addressing modes of DSP processor.

b) Explain in detail about following registers in TMS320C5X processor

i) Auxillary Register ii) Index Register

iii) Block move address register. [8+8]

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