2002 SCHEME

USN | | | | | | | | | | |

EE55

Fifth Semester B.E. Degree Examination, Dec.09/Jan.10
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Compute the 4-point DFT of the sequence $x(n) = \cos(\frac{\pi}{4}n) + \sin(\frac{\pi}{4}n)$. Use linearity property. **(08 Marks)**

b. The five points of the 8-point DFT of a real valued sequence are X(0) = 0.25, X(1)=0.125+j0.3, X(4) = X(6) = 0, X(5) = 0.125 – j0.05. Determine the remaining points of the DFT. **(04 Marks)**

c. Find 6-point DFT of the sequence
$X(n) = 4\delta(n) + 3\delta(n - 1) + 2\delta(n - 2) + \delta(n - 3)$ **(08 Marks)**

2 a. g(n) and h(n) are two sequences of length 6. g(n) = {4.1, 3.5, 1.2, 5, 2, 3.3}. The DFT's G(k) and H(k) are related by the circular frequency shift as $H(k) = G((k-3))_6$. Determine h(n) without computing DFT & IDFT. **(08 Marks)**

b. Find the output y(n) of a filter whose impulse response is h(n) = {1, 2} and input signal x(n)={1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1}, using overlap add method. Use only 5-point circular convolution. **(12 Marks)**

3 a. Determine the IDFT of X(k) = {4, 1– j2.414, 0, 1– j0.414, 0, 1+j0.414, 0, 1+j2.414} using Inverse-Radix 2 DIF-FFT algorithm. Draw signal flow graph. **(10 Marks)**

b. Develop a decimation in time-FFT algorithm for evaluating the DFT for N = 6. Draw signal flow graph. **(10 Marks)**

4 a. A system is described by the following input-output relation $y(n)=\frac{1}{2}y(n-1)-\frac{1}{4}y(n-2)+x(n)+x(n-1)$. Obtain the expression for system function H(z) and draw direct form II structure. **(06 Marks)**

b. Obtain cascade realization of the system described by the difference equation $y(n)=\frac{3}{4}y(n-1)-\frac{1}{8}y(n-2)+x(n)+\frac{1}{3}x(n-1)$ **(06 Marks)**

c. Obtain parallel realization of the system $H(z) = \frac{6z^2+7z+1}{z^2+0.75z+0.125}$. **(08 Marks)**

5 a. Design a Butterworth analog high pass filter that will meet the following specifications:
i) Maximum passband attenuation = 2dB ii) Passbandedge frequency = 200rad/sec
iii) Minimum stopband attenuation = 20 dB iv) Stopband edge frequency = 100 rad/sec. **(10 Marks)**

b. Derive mapping function used in transforming analog filter to digital filter by bilinear transformation. Show that this transformation preserves the frequency selectivity & stability properties of analog filter. **(10 Marks)**

6 a. Using bilinear transformation, design a digital low pass Chebyshev filter that will meet the following specifications.
i) 3 dB ripple in the passband $0 \le w \le 0.3\pi$
ii) Atleast 20dB attenuation in the stopband $0.6\pi \le w \le \pi$ **(12 Marks)**

b. Using impulse invariant transformation, transform analog filter $Ha(s)=\frac{s+1}{s^2+5s+6}$ into H(z).
Take T = 0.1 sec. **(08 Marks)**

7 a. A low pass filter is to be designed with following specifications.

$$H_d(e^{jw}) = e^{-j2w} \quad |w| < \pi/4$$
$$= 0 \quad \pi/4 < |w| < \pi$$

Determine filter coefficients h(n), if w(n) is a rectangular window defined as

$$w_R(n) = 1 \quad 0 \le n \le 4$$
$$= 0 \quad \text{Otherwise}$$

Also find the frequency response, H(w) of the resulting FIR filter. **(12 Marks)**

b. The frequency response of an FIR filter is given by
$H(w) = e^{-j3w}(1 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w)$
Determine the coefficients of the impulse response h(n) of the FIR filter. **(08 Marks)**

8 Write explanatory notes on :
a. Architecture of TMS320C5X processor **(08 Marks)**
b. Effects of window characteristics on filter response. **(06 Marks)**
c. Applications of TMS320C5X processors. **(06 Marks)**

* * * * *