Reg. No. : .....

Name : .....

First Semester M.Tech. Degree Examination, March 2013
(2008 Scheme)
Branch : Electrical and Electronics
Stream : Power Control and Drives
EDC 1003 : ADVANCED DIGITAL SIGNAL PROCESSING AND APPLICATIONS

Time : 3 Hours Max. Marks : 100

***Instruction :** Answer **any five full** questions.*

1. a) The Z - transform of a sequence x[n] is $X[z]=\frac{z+2z^2+Z^{-3}}{1-3z^{-4}+z^{-5}}$. If the region of convergence includes the unit circle, find the DTFT of x[n] at $\omega=\pi$] 5

   b) Consider the length - 12 sequence defined for $0 \le n \le 11$

   $$x[n] = \{3, -1, -2, 5, -1, 0, 1, -4, 6, 2, 5, -3\}$$

   With a 12 point DFT given by X[k], $0 \le k \le 11$. Evaluate the following functions of X[k] without computing the DFT.

   i) X[0] ii) X[6]

   iii) $\sum_{k=0}^{11} X[k]$ iv) $\sum_{k=0}^{11} e^{-j(4\pi k/6)} X[k]$

   v) $\sum_{k=0}^{11} |X[k]|^2$ 15

2. a) A band limited signal x(t) is sampled by a train of rectangular pulses of width τ and period T. Find an expression for the sampled signal. Determine the spectrum of the sampled signal. 6

   b) Let $x[n] = \delta[n] + 3\,\delta[n-1] + 3\,\delta[n-2] + 2\,\delta[n-3]$ and $h[n] = \delta[n] + \delta[n-1] + \delta[n-2] + 2\,\delta[n-3]$. Let X[k] and H[k] be the 5 point DFTs of x[n] and h[n] respectively. If Y[k] = X [k].H[k], then find the sequence y[n] = IDFT of Y[k]. 8

   c) If x[n] ={4, 3, 2 1}, find a finite length sequence y[n] that has a six point DFT Y[k] given by $Y[k] = W_6^{4k} X[k]$, where X[k] is the DFT of x[n]. 6

P.T.O.

3. a) Consider an FIR filter with the system function

$H(z) = 1+ 2z^{-1} + 3z^{-2} + 4z^{-4} + 3z^{-5} + 2z^{-3} + 3z^{-6}$. Implement the filter using least number of delays. Will the filter have linear phase ? 8

b) Obtain the direct form I and cascade realizations for the system described by

$$H(z)= \frac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$$ 12

4. a) Explain the characteristics required for a good window function. 5

b) Design an FIR digital high pass filter for a cut off frequency of 200 Hz and sampling frequency of 2000 Hz, with 6 delays using triangular window. Draw the filter structure. 15

5. a) Explain the concept of frequency warping. 4

b) Using Bilinear transformation, design a digital band pass Chebyshev filter with the following specifications.

Sampling Frequency = 8 kHz

Maximum Pass band attenuation α_p = 2 db, 800 Hz $\leq f \leq$ 1600 Hz

Minimum Stop band attenuation α_s = 20 db, 0 Hz $\leq f \leq$ 400 Hz and 20000 Hz $\leq f \leq \infty$ 16

6. a) Obtain the 8 point DFT of a sequence x[n]= {1, 2, 3, 4, 4, 3, 2, 1} using radix 2 DIF-FFT algorithm. 8

b) Explain the addressing modes of the Texas Instruments TMS 320 F 240 Digital Signal Processor. 6

c) Write a Matlab program to find the DFT of the given sequence and to plot the magnitude and phase spectrum. 6