B.E. Sem. VII (EXTC) Rev - DTSP May/2005

Ex-22-4-Nk 94

Con. 2322-05. AM-8524

(REVISED COURSE)

(3 Hours) [Total Marks : 100

N.B. (1) Question No. 1 is **compulsory.**
(2) Attempt any **four** questions from remaining **six** questions.

1. (a) Show the mapping from s-plane to z-plane using impulse invariance method and explain its limitations. 20
(b) Convert the following analog filter system function into digital IIR filter by means of impulse invariance method, $H_a(s) = \frac{s + 0{\cdot}1}{(s+0{\cdot}1)^2 + 16}$.
(c) Compute 4 pt. DFT of the following sequence
$x[n] = \{ 1 \cdot 1\ 2\ 3 \}$
(d) Detemine the number of bits required to compute an FFT of 2048 points with an SNR of 30 dB.
(e) Justify that an LTI system is stable if its impulse response is absolutely summable.

2. (a) A digital low pass filter is required to meet the following specifications : 10

Pass band ripple	:	$\leq$ 1 dB
Pass band edge	:	4 kHz
Stop band attenuation	:	$\geq$ 40 dB
Stop band edge	:	6 kHz
Sample rate	:	24 kHz.

Find the order of Butterworth and Chebyshev filter using bilinear transformation.
(b) The desired frequency response of a lowpass filter is 10

$$H_d(e^{jw}) = e^{-3jw} \quad \text{for} \quad -\frac{3\pi}{4} \leq w \leq \frac{3\pi}{4}$$

$$= 0 \qquad \frac{3\pi}{4} < |w| < \pi$$

Determine $H(e^{jw})$ for M = 7 using Blackman window.

3. (a) $x_1[n] = \{ 2, 1, 2, 1 \}$ and $x^2[n] = \{ 1, 2, 3, 4 \}$ perform the circular convolution of the above two sequences using DFT/IDFT method i.e. property of DFT 12
(b) Find 8-point DFT of the sequence using DIT-FFT algorithm 8
$x[n] = \{ 1, 2, 1, 2, 1, 2, 1, 2, \}$.

4. (a) Consider an FIR filter with system function $H(z) = 1 + 2{\cdot}88z^{-1} + 3{\cdot}4048z^{-2} + 1{\cdot}74z^{-3} + 0{\cdot}4z^{-4}$. 10
Sketch the Lattice realization of the filter and determine the corresponding input output equations. Is the system minimum phase ?
(b) (i) $x_1[n] = \{ 1, 2, 3, 4 \}$ and $x_2[n] = \{ 5, 6, 7, 8 \}$ 6
Find $x_1[k]$ and $x_2[k]$ of the above sequences by performing DFT computation only once.
(ii) Explain the properties of symmetry and periodicity of a phase factor. 4

5. (a) An FIR filter is described by the difference equation 10
$y[n] = x[n] + x[n - 10]$
(i) Compute and sketch its magnitude and phase response
(ii) Determine its response to the input

$$x[n] = 10 + 5\cos\left(\frac{2\pi}{5}n + \frac{\pi}{2}\right) \quad -\infty < n < \infty$$

(b) Determine the order and the poles of a low pass Butterwort filter that has a – 3dB bandwidth of 500 Hz and an attenuation of 40 dB at 1000 Hz. Also draw the rough sketch of frequency response characteristics of the Butterworth filter. 10

6. (a) Find the magnitude response of a linear phase FIR filter at zero frequency if the filter has antisymmetry coefficients. 6
(b) (i) Compare the characteristics of different window functions. 8
(ii) Explain energy compaction capability of Discrete Cosine Transform. 6

7. (a) Compare DSP processor with general purpose processor. 6
(b) Explain the Goertzel Algorithm. 6
(c) Explain any one method of linear FIR filtering a long data sequence using DFT. 8