B.E / VI / Rev. / EXTC / May'06 / K.T. EXAM / D.T.S.P. / 16/5/06

[REVISED COURSE]

CON/2705-06. TV-9172

(3 Hours) [Total Marks : 100

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

Q.1 a) Consider a filter with transfer function [4]

$$H(z) = \frac{Z^{-1} - a}{1 - a Z^{-1}}$$

Identify the type of filter and justify it.

b) One of the zeros of an antisymmetric FIR filter lies at $Z = 0.2\, e^{j\pi/3}$. [4]
What is the minimum order of this filter? Show all zero locations.

c) If x(n) = {1 2,3,4} Find DFT X(K). [4]
Using the above result and not otherwise find DFT of x1(n)={1 ,-2,3,-4}

d) Show the mapping from S-plane to Z plane using impulse invariance method and explain its limitation. [4]

e) Show that the zeros of a linear phase FIR filter occur at reciprocal locations, also show that FIR with antisymmetric impulse response and odd length will compulsory have zero at Z= +1 and Z= -1 [4]

Q.2 a) Derive the DFT of the sample data sequence x(n)={1,1.2,2,3,3} and compute the corresponding amplitude and phase spectrum. [10]

b) IF x(n)={1,2,3,4} find DFT X(K). [10]
Using X(K) obtained above and not otherwise find the DFT of the following sequences
$x_1(n)$={4,1,2,3}
x2(n)={2,3,4,1}
x3(n)={3,4,1,2}
x4(n)={4,6,4,6}

Q.3 a) i) Given X(k)={ 2, - 6j, 2- 8j, 6j, 2, - 6 j, 2 + 8 j, 6 j }, [8]
Find x(n) by using any IFFT algorithm
ii) Explain briefly where overlap add and overlap save methods are used? [2]

b) Perform circular convolution of following signals using DFT/IDFT technique [10]
x1(n)=cos(2πn/N) $0 \le n \le N-1$
x2(n)=sin(2πn/N) $0 \le n \le N-1$

Q.4 a). Frequency response of a FIR filter is [10]
$H(e^{jw}) = e^{-j3\omega}(2+1.8\cos 3\omega + 1.2\cos 2\omega + 0.5\cos\omega)$
Find the impulse response of the filter, identify the filter type based on pass band

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b) Determine the zeros of the following FIR systems and indicate whether the system is minimum phase, maximum phase, or mixed phase [10]

$H_1(Z)=6+Z^{-1}-Z^{-2}$

$H_2(Z)=1-Z^{-1}-6Z^{-2}$

$H_3(Z)=1-(5/2)Z^{-1}-(3/2)Z^{-2}$

$H_4(Z)=1+(5/3)Z^{-1}-(2/3)Z^{-2}$

Comment on the stability of the minimum and maximum phase system

Q.5 a) i) Obtain linear phas realization [5]

H(n)={1,5/2,3/2 5/2,1}

ii) Write short notes on Digital resonator [5]

b) The difference equation for causal system is given by [10]

$y(n)-3/4y(n-1)+1/8y(n-2)=x(n)+1/3\ x(n-1)$

Draw the following realization

(i) Cascade form in terms of 1st order sections

(ii) Parallel from in terms of 1st order sections

Q.6 a) A LPF has following specifications [10]

$0.8 \le |H(e^{j\omega})| \le 1$ for $0 \le \omega \le 0.2\pi$

$|H(e^{j\omega})| \le 0.2$ for $0.6\pi \le \omega \le \pi$

Find the filter order and analog cutoff frequency Ω_c if

(i) Bilinear transformation technique is to be used for designing

(ii) Impulse invariance method is to be used for designing

b) (i)A digital LPF is required to meet the following specifications: [5]

Pass band ripple	:	≤ 1 dB
Pass band edge	:	4 KHz
Stop band attenuation:		≥ 40 dB
Stop band edge	:	6 KHz
Sample rate	:	24 kHz

Determine the order of the Butterworth filter

(ii) Using trapezoidal rule of integration show that [5]

$$S = \frac{2(1-Z^{-1})}{T(1+Z^{-1})} \quad \& \quad \Omega=(2/T)\tan \omega/2$$

Q.7 (a) Explain energy compaction capability of DCT (DCT II). [5]

(b) Compare the DSP processor and general purpose processor. [5]

(c) Explain the Goertzel algorithm. [5]

(d) Explain the properties of Symmetry and periodicity of phase factor. [5]