TE - SEM-VI - EXTC - CBGS

DTSP

QP Code : 5131

(3 Hours) [Total Marks : 80

N.B.: (1) Question **No.1** is **compulsory**.
(2) Solve any **three** questions from remaining questions.
(3) In all **four** questions to be attempted.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Sketch the frequency response and identify the following filters based on their pass band 20

(i) $h[n] = \left\{1, -\frac{1}{2}\right\}$

(ii) $H[z] = \frac{z^{-1} - a}{1 - az^{-1}}$

(b) Justify DFT as a linear transformation.

(c) Explain the frequency warping in Bilinear transformation.

(d) What is multi rate DSP ? Where it is required ?

2. (a) An analog filter has transfer function 8

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 16}$$

Determine the transfer function of digital filter using bilinear transformation. The digital filter should have specification $\omega_r = \frac{\pi}{2}$

(b) Explain the effects of coefficient quantization in FIR filters. 8

(c) The first five points of eight point DFT of real valued sequence are 4
{ 0.25, 0.125-j0.3018, 0, 0.125-j0.0518, 0 }.
Determine the remaining three points.

3. (a) $x[n] = \begin{cases} 1, & 0 \le n \le 3 \\ 0, & 4 \le n \le 7 \end{cases}$ 10

(i) Find DFT X [k]

(ii) Using the result obtained in (i) find the DFT of the following sequences.

$$x_1[n] = \begin{cases} 1, & n = 0 \\ 0, & 1 \le n \le 4 \\ 1, & 5 \le n \le 7 \end{cases} \quad \text{and} \quad x_2[n] = \begin{cases} 0, & 0 \le n \le 1 \\ 1, & 2 \le n \le 5 \\ 1, & 6 \le n \le 7 \end{cases}$$

(b) Implement a two stage decimator for the following specifications: Sampling rate of the input signal= 20,000 Hz 10
M = 100
Pass band = 0 to 40 Hz , Pass band ripple = 0.01,
Transition band = 40 to 50 Hz, Stop band ripple = 0.002

4. (a) By means of FFT-IFFT technique compute the linear convolution of x [n] = {2,1,2,1} and h [n] = {1,2,3,4} 8

(b) Consider the following specifications for a low pass filter 8

$0.99 \le |H(e^{j\omega})| \le 1.01 \quad 0 \le \omega \le 0.3\pi$ and

$|H(e^{j\omega})| \le 0.01 \quad 0.5\pi \le |\omega| \le \pi$

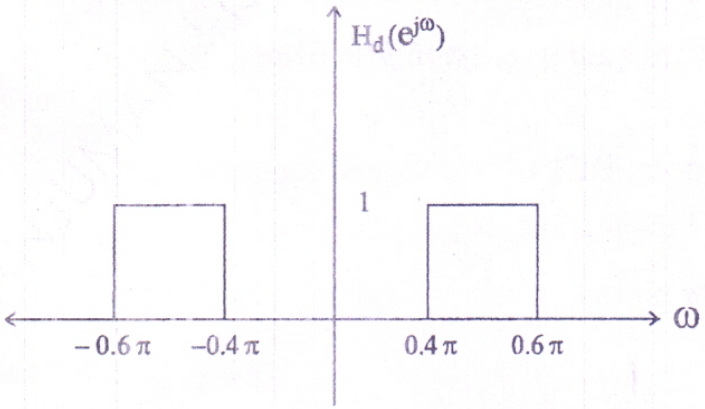
Design a linear phase FIR filter to meet these specifications using the window design method.

(c) Identify whether the following system is minimum phase, maximum phase, mixed phase. 4

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

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

5. (a) Design digital FIR filter for following specification. 10



Use hamming window and assume M = 7.

(b) Design digital low pass IIR Butterworth filter for the following specifications: 10

pass band ripple: $\leq$ dB

pass band edge: 4 kHz

stop band attenuation: $\geq$ 40dB

stop band edge : 6 kHz

Sample rate : 24 kHz

Use bilinear transformation

6. (a) Write a short note on 12

(i) Dual tone Multi-frequency Signal Detection.

(ii) Different methods for digital signal Synthesis.

(b) The transfer function of digital causal system is given as follows : 8

$$H(z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$$

Draw cascade form, parallel form realization.

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Correction:

Q5(b) Design digital low pass IIR Butterworth filter for the following specification
passband ripple <= 1 dB
intsead of passband ripple <= dB

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Correction:

Read as :

3a)

ii)

x2 [n] = 0 0 <=n<=1

1 2<=n<=5

0 6<=n<=7

instead of :

x2 |n| = 0 0 <=n<=1

1 2<=n<=5

1 6<=n<=7

4 (c) Identify whether the following system is minimum phase, maximum phase, mixed phase

(i)H1(Z)=6+Z^-1-Z^-2

instead of

H1(Z)=6+Z^-1+Z^-2

NOTE: TAKE PRINT OUT'S AND DISTRIBUTE TO STUDENT

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