Q.P. CODE: 37019

Time: 3 Hours **Marks: 80**

N.B: (1) Questions No.1 is compulsory.
(2) Attempt any three questions out of remaining five questions.
(3) Assume suitable data if required.
(4) Figures to the right indicate full marks.

Q 1.Solve any four

a) Determine the zeros of the following systems and indicate whether the system is minimum, maximum or mixed phase.

1) $H_1(z) = 6+z^{-1}+6z^{-2}$
2) $H_2(z)= 1-z^{-1}-6z^{-2}$ 5

b) Define group delay and phase delay. 5

c) Compare FIR and IIR filters 5

d) What is frequency warping in bilinear transformation. 5

Q2 a) Compute DFT of sequence x(n)={ 2,1,2,1,1,2,1,2 } using DIT-FFT algorithm. 10

b) A low pass filter is to be designed with following desired frequency response.

$Hd(e^{jw})=e^{-j2w}$ $-\frac{\pi}{4}\leq w \leq \frac{\pi}{4}$

$=0$ $\frac{\pi}{4}< w \leq \pi$

Determine the filter coefficients $h_d(n)$ if the window function is defined as

$w(n)=1$ $0\leq n\leq 4$

$=0$ otherwise

Also determine the frequency response $H(e^{jw})$ of the designed filter. 10

Q 3 a)The transfer function for discrete time system is given as

$$H(z)= \frac{1+\frac{1}{2}Z^{-1}}{1-\frac{3}{4}Z^{-1}+\frac{1}{8}Z^{-2}}$$

i) Draw Direct Form I and Form II realization

ii)Draw cascaded and parallel form realization 10

b) Explain subband coding of speech signal as a application of multirate signal processing. 10

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Q4 a) Develop composite radix DITFFT flow graph for N=6=2×3. 10

b) Design a digital Butterworth filter that satisfies following constraints using bilinear transformation method. Assume Ts=1s.

$0.9 \leq |H(e^{jw})| \leq 1 \qquad 0 \leq w \leq \frac{\pi}{2}$

$|H(e^{jw})| \leq 0.2 \qquad \frac{3\pi}{4} \leq w \leq \pi$ 10

Q 5 a) Show the mapping from S plane to Z plane using impulse invariant method. Explain its limitations. Using this method determine H(z) if

$H(s)=\frac{10}{(s+5)(s+2)}$ if Ts=0.2s. 10

b) If x(n)={ 1,2,3,} and h(n)= {1,0}

1) Find linear convolution using circular convolution
2) Find circular convolution using DFT-IDFT. 10

Q6 Write short notes on following,

a. Musical Sound Processing. 07

b. Dual tone multi frequency signal detection. 06

c. Subband Coding of Speech signals. 07

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