BE (E&TRX) Sem VII
F.T. & A.
4/05/09
11-2

Con. 2846–09. **VR–4713**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** out of remaining **six** questions.
(3) Assume **suitable** data whenever **necessary** and justify it.

1. Solve any **four** :– **20**

   (a) Explain why a digital FIR filter designed using Rectangular window has more ripples in its magnitudes response characteristic than the filter designed using any other window.

   (b) State whether following statement is true or false. Justify your answer by giving pole zero diagram. "An antisymmetric second order linear phase FIR filter has one possible pole zero diagram whereas symmetric type filter has more than one possibility."

   (c) Show Pole Locations of a fourth order normalized Butterworth filter. What cutoff frequency this filter has ?

   (d) State true or false and justify. "The physically realizable and stable IIR filter can not have a Linear Phase."

   (e) Why a Linear phase FIR filter having odd symmetry in coefficients can never be a Low Pass filter ?

2. Design a Digital Chebyshev Low Pass filter with the following specifications **20**

   α_p = 1 dB in the Passband $0 \leq w \leq 0.2\ \pi$

   α_s = 15 dB in the Stopband $3\ \pi \leq w \leq \pi$

   Using Bilinear Transformation assume T = 1 sec.

3. (a) A L.P. (Low Pass) Digital FIR Filter meeting the following specification is required **8**

   $\alpha_p \leq 0.1$ dB, $\alpha s \geq 44$ dB

   W_p = 30 rad/s, W_s = 50 rad/s

   W_{SF} = 200 rad/s

   Find only order of filter using Kaiser window.

   (b) Draw a lattice filter implementation for the all pole filter **12**

   $$H(z) = \frac{1}{1 - 0.2z^{-1} + 0.4z^{-2} + 0.6z^{-3}}$$

   and determine the number of multiplications, addition and delays required to implement this filter. Compare this structure to direct form realization of H(z) in terms of multipliers, adders and delays.

4. (a) Using bilinear transformation design a high pass filter which has monotonic behaviour in Passband having 3 dB frequency of 1000 Hz and down 10 dB at 350 Hz with monotonic response in stopband. The sampling frequency is 5000 Hz. **12**

[TURN OVER

(b) Show frequency sampling realization diagram for a Linear Phase FIR filter of length 8, which has symmetric unit sample response and a frequency response that satisfies the condition **8**

$$H\left(\frac{2\pi k}{8}\right) = \begin{cases} 1 & \text{for } k = 0,1 \\ 0.4 & \text{for } k = 2 \\ 0 & \text{otherwise} \end{cases}$$

Use real coefficients.

5. (a) The desired frequency response of the filter is – **12**

$$Hd(e^{jw}) = 0, \quad |w| \leq \pi/4$$

$$= e^{-j2w}, \quad \pi/4 \leq |w| \leq \pi$$

Identify the type of filter and find its length using above response. Design this filter using Blackman window and plot its magnitude response.

(b) S.T. $s = \frac{2}{T}\frac{\left(1-z^{-1}\right)}{\left(1+z^{-1}\right)}$ **8**

in Bilinear transformation. Also explain mapping between S-plane and Z-plane for BLT.

6. (a) Show the Pole Location of a second order normalized Butterworth filter and find its T.F. convert this analog T.F. into Digital filter using impulse invariant method with T = 1 sec. **12**

(b) Find the impulse response of a Linear phase third order FIR filter having symmetric coefficients. The filter should have only one real zero. Give reasoning for the selection of zero. **8**

7. Solve any **three** :– **20**

(a) What is the major problem associated with designing of FIR filter using window method and frequency sampling method. Explain how optimal linear phase FIR filter can be designed to overcome these problems.

(b) Write short note on analog to analog frequency transformation.

(c) State advantage of elliptic filter over Butterworth and Chebyshev filter. Explain design procedure for elliptic filter.

(d) Explain dead band effect occur due to quantization in the finite precision arithmetic operation.