BE - Sem-VII - Old - EXTC

DTSP

10/12/15

QP Code : 2184

(3 Hours) [Total Marks : 100

N.B. : (1) Question **No.1** is **compulsory**.
(2) Answer any **four** questions out of remaining **six** questions.
(3) **Figure** to the **right** indicates **full marks**.
(4) **Illustrate** the answers with **sketches** wherever **required**.

1. (a) Explain the frequency warping in Bilinear transformation. 5
(b) Justify DFT as a linear transformation. 5
(c) One of the zeros of ant symmetric FIR filter is at $0.5 < 60°$, show locations of other zeros. What is minimum order of this filter? 5
(d) State and prove the DFT property for circular frequency shift. 5

2. (a) Draw a lattice filter implementation for the All pole filter, 10

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

and determine the number of multiplications, additions and delays required to implement the filter.
(b) Find X(k) using DIF-FFT algorithm for $x[n] = n + 1$ and $N = 8$ 10

3. (a) By means of FFT-IFFT technique compute the circular convolution of the sequences 10
$x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{5, 6, 7, 8\}$
(b) Compare minimum phase, maximum phase and mixed phase system. Also identify whether the following system is minimum phase, maximum phase, mixed phase system. 10

$$H_1(z) = 1 - \tfrac{5}{2}z^{-1} - \tfrac{2}{2}z^{-2}$$

$$H_2(z) = 1 - \tfrac{5}{2}z^{-1} - \tfrac{2}{3}z^{-2}$$

4. (a) Design low pass filter for following specification 10

$$H_d\left(e^{j\omega}\right) = \begin{cases} e^{-j3\omega}, & -\dfrac{3\pi}{4} \le \omega \le \dfrac{3\pi}{4} \\ 0, & \dfrac{3\pi}{4} < \omega < \pi \end{cases}$$

Determine $H(e^{-j\omega})$ for $M = 7$ using Hamming window.

TURN OVER

(b) Explain multirate sampling? What are the basic methods? List the advantages and disadvantages and its applications. Explain the different filter banks and also explain sub band coding. 10

5. (a) Design a digital Butterworth filter that satisfies the following constraint using bilinear Transformation, Assume T = 1s 10

$$0.9 \le H\left(e^{j\omega}\right) \le 1, \quad 0 \le \omega \le \frac{\pi}{2}$$

$$H\left(e^{j\omega}\right) \le 0.2, \quad \frac{3\pi}{4} \le \omega \le \pi$$

(b) Show that the zeroes of a linear phase FIR filter occur at reciprocal locations. Also show that 10

(i) FIR with symmetric impulse response and even length will compulsory have a zero at z = -1.

(ii) FIR with anti symmetric impulse response and odd length will compulsory have a zero at z = + 1 and z = -1.

6. (a) The transfer function of discrete causal system is given as 10

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

(i) Find the difference equation

(ii) Draw cascade and parallel realization

(iii) Calculate the impulse response of the system

(iv) Find the impulse response of the system

(b) If $x(n) = \{1, 2, 3, 4\}$ find DFT X[k]. Using X[k] obtained & not otherwise, find the DFT of the sequences:- 10

(i) $x_1(n) = \{4, 1, 2, 3\}$

(ii) $x_2(n) = \{2, 3, 4, 1\}$

(iii) $x_3(n) = \{3, 4, 1, 2\}$

(iv) $x_4(n) = \{4, 6, 4, 6\}$

7. Write short notes (any **Four**) : 20

(a) Application of DTSP for RADAR system

(b) Digital Resonator

(c) Goertzel algorithm

(c) Overlap add & overlap save method for long data sequence

(e) Frequency domain characteristics of the different types of window functions

---