

BTECH
(SEM V) THEORY EXAMINATION 2018-19
DIGITAL SIGNAL PROCESSING

Time: 3 Hours

Total Marks: 70

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief.

2 x 7 = 14

- a) What is the main disadvantage of direct form realization?
- b) What is the wrapping effect?
- c) Compare FIR and IIR filter?
- d) What are the advantages of Kaiser window?
- e) What is window and why it is necessary?
- f) What is down sampling and up sampling?
- g) Define decimation?

SECTION B

2. Attempt any three of the following:

7 x 3 = 21

- a) Obtain the Cascade form realization-
 $y(n) = y(n-1) - 1/2 y(n-2) + 1/4 y(n-2) + x(n) - x(n-1) + x(n-2)$
- b) Find the order and cut off frequency of a digital filter with the following specification-

$$0.89 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq \omega \leq 0.4\pi$$

$$|H(e^{j\omega})| \leq 0.18, \quad 0.6\pi \leq \omega \leq \pi \quad \text{use the impulse invariance method?}$$

- c) The desired response of a low-pass filter is $H_d(e^{j\omega}) = e^{-3j\omega}, \quad -3\pi/4 \leq \omega \leq 3\pi/4$

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

- d) Find the 8 point DFT of the sequence $x(n) = \{1, 1, 1, 1, 1, 0, 0, 0\}$ using DIT FFT?
- e) Discuss about Quadrature mirror filters in detail?

SECTION C

3. Attempt any one part of the following:

7 x 1 = 7

- a) Obtain the parallel form realization-

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

- b) Obtain the Direct form I and II form realization

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

4. Attempt any one part of the following:

7 x 1 = 7

- a) Using bilinear transformation, design a Butterworth filter which satisfies the following

$$\text{condition } 0.8 \leq |H(e^{j\omega})| \leq 1, \quad 0 \leq \omega \leq 0.2\pi$$

$$|H(e^{j\omega})| \leq 0.2, \quad 0.6\pi \leq \omega \leq \pi$$

- b) What is the difference Butterworth and Chebyshev? Explain the frequency transformation is done?

5. Attempt any one part of the following:

7 x 1 = 7

- a) Using a rectangular window technique design a low pass filter with passband gain of unity, cutoff frequency of 1000 Hz and working at a sampling frequency of 5 kHz. The length of the impulse response should be 7.

- b) Discuss the Finite Word length effects in digital filters?

6. Attempt any one part of the following:

7 x 1 = 7

- a) Find the linear convolution using circular convolution of the following sequence $x(n) = \{1, 2, 1\}$ $h(n) = \{1, 2\}$?

- b) Find the 8 point DFT of the sequence $x(n) = \{1, 2, 3, 4, 3, 2, 1\}$ using DIF FFT?

7. Attempt any one part of the following:

7 x 1 = 7

- a) What is multirate digital signal processing? Discuss about application areas of it.

- b) Discuss about Interpolation and Sampling rate conversion in detail?