Printed Pages: 2 **Sub Code: NEC011**

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B.Tech.
(SEM 6th) THEORY EXAMINATION 2018-19
Digital Signal Processing

Time: 3 Hours ***Total Marks: 100***

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

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. What do you mean by Gibbs phenomenon?
b. Calculate the Chebyshev Polynomial $C_3(x)$.
c. What is the difference between Linear & Circular Convolution?
d. What is the computational complexity of the direct form-I & direct form-II.
e. Find the DFT of the given sequence, x(n) = {1, -2, 3, 4} by Linear Transformation technique.
f. State & Prove the multiplication property of DFT.
g. Compare the number of complex addition & complex multiplication for FFT & direct computation of the DFT.
h. What do you mean by analog & digital filters?
i. What do you mean by Frequency Compression Effect?
j. Write the expression for Blackman's window function.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. Find the 8-point DFT of the given sequence

$$x(n) = 18 * \sin(\frac{n\pi}{8} + 3)$$

Also find its Phase & magnitude spectrum.

b. Derive & Draw the flow graph for DIT FFT algorithm for given sequence x (n) = 2^{n+1}, where n = 0, 1, 2,……., 7
c. Why we are using Kaiser Window? Give your justification using suitable example.
d. Draw the Direct form- I, Direct form-II, Cascade & Parallel realization of the given systems function

$$H(z) = \frac{z(z+5)}{z^2 + 0.5z + 0.2}$$

e. Briefly explain the concept of Bilinear Transformation Method.

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Derive & Draw the flow graph for DIF FFT algorithm for given sequence x (n) = 2^{n+4}
(b) Find DIF IFFT algorithm for given sequence X(k) = {36, -4+j9.656, -4+4j , -4+j1.656, -4, -4-j1.656, -4-j4, -4-j9.656}.

4. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Design a Digital Butterworth filter to satisfy the following constraints

$$0.65 \leq |H(e^{jw})| \leq 1 \quad ,0 \leq w \leq 0.2\pi$$
$$|H(e^{jw})| \leq 0.1 \quad ,0.5\pi \leq w \leq \pi$$

(b) Design a Digital Chebyshev filter to satisfy the following constraints

$$0.42 \leq |H(e^{jw})| \leq 1 \quad ,0 \leq w \leq \pi/4$$
$$|H(e^{jw})| \leq 0.8 \quad ,\pi/2 \leq w \leq \pi$$

5. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Convert the analog Filter with system function

$$H(s) = \frac{81}{[(s+0.4)^2 + 81]}$$

in to a digital IIR filter using Bilinear Transformation. The Digital Filter should have a resonant Frequency of $w_r = 0.42\pi$

(b) Enlist any five properties of DFT & prove it each & every one.

6. Attempt any *one* part of the following: **10 x 1 = 10**

(a) The desired response of a low pass filter is

$$H(e^{jw}) = \begin{cases} e^{-j6w} & , -\frac{3\pi}{8} \leq w \leq \frac{3\pi}{8} \\ 0 & , \frac{3\pi}{8} \leq w \leq \pi \end{cases}$$

Determine $H(e^{jw})$ for M = 7 using Blackman window

(b) Explain the realization of linear phase FIR filter for even and odd samples. Obtain FIR linear phase cascade realization of the system function.

$H(z) = (1 + 0.5z^{-1} + z^{-2})(1+0.25z^{-1}+z^{-2})$

7. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Derive & Draw the flow graph for inverse FFT algorithm.

(b) What is difference between simple convolution & overlap adds method? Explain both with suitable example.