Printed Page:- 04 **Subject Code**:- **AEC0601**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM:VI CARRY OVER THEORY EXAMINATION-AUGUST 2023

Subject: Digital Signal Processing

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **20**

1. Attempt all parts:-

1-a. The transformations are required for 1) Analysis in time or frequency domain 2) Quantization 3) Easier operations 4) Modulation. (CO1) 1

(a) 1, 2 and 3 are correct

(b) 1 and 2 are correct

(c) 1 and 3 are correct

(d) All four are correct

1-b. The DFT is preferred for 1) Its ability to determine the frequency component of the signal 2) Removal of noise 3) Filter design 4) Quantization of signal. (CO1) 1

(a) 1, 2 and 3 are correct

(b)) 1 and 2 are correct

(c)) 1 and 3 are correct

(d) All the four are correct

1-c. The relationship between analog and digital frequency in bilinear transformation method will be.... (CO2) 1

(a) $\omega=\Omega T$

(b) Ω=2/T(tan(ω/2))

(c) ω=2/T(tan(Ω/4))

(d) None of these

1-d. Impuse invariant method is suitable for.. (CO2) 1

(a) HPF

(b) BPF

(c) BSF

(d) all type of filter

1-e. The effect due to finite precision representation of number are called..... (CO3) 1

(a) Finite word length

(b) truncation

(c) quantization

(d) None of these

1-f. The amplitude range of oscillations in zero input limit cycle are referred to as (CO3) 1

(a) Dead band

(b) Limit band

(c) cycle band

(d) zero band

1-g. The factors influence the choice of realization of structure is... (CO4) 1

(a) Memory requirement

(b) Computational complexity

(c) parallel processing & pipelining

(d) All of the mentioned

1-h. .....realization is called realization with minimum number of mutipliers. (CO4) 1

(a) Direct form

(b) cascade

(c) parallel

(d) Linear phase

1-i. Which of the following is the disadvantage of sampling rate conversion by converting the signal into analog signal? (CO5) 1

(a) New sampling rate can be arbitrarily selected

(b) Signal distortion

(c) Quantization effects

(d) Signal distortion & Quantization effects

1-j. In signal processing, sub-band coding (SBC) is any form of transform coding that ..... a signal into several different frequency bands, typically by using a fast Fourier transform, and encodes each one independently. (CO5) 1

(a) breaks

(b) add

(c) substract

(d) none of these

2. Attempt all parts:-

2.a. Write the basic properties of twiddle factor W_N . (CO1) 2

2.b. What is filter transformation process? (CO2) 2

2.c. What is Gibbs phenomenon in filters? (CO3) 2

2.d. Draw the block diagram of digital system. (CO4) 2

2.e. What is frequency domain equation of decimation process? (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. State and prove the Periodicity and Linearity property of DFT. (CO1) 6

3-b. Draw the basic butterfly diagram for radix 2 DIT-FFT and DIF-FFT. (CO1) 6

3-c. Briefly explain the steps for designing of digital filter from an analog prototype filter using two different approaches. (CO2) 6

3-d. Obtain the system function of normalized Butterworth filter for order N= 2 and 3. (CO2) 6

3.e. Explain the characteristic of Kaiser window with suitable diagram. Also derive the expression for frequency response of Kaiser window. (CO3) 6

3.f. Write a short note on (a) recursive (b) non recursive system. (CO4) 6

3.g. Write down the parameters on which the choice of a particular adaptive algorithm depends. (CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. State and prove circular convolution property of DFT. What is zero padding? What are its uses? (CO1) 10

4-b. Compute IDFT of the sequence X(k)= {7, -0.707-j0.707, -j, 0.707-j0.707, 1, 10

0.707+j0.707, j, -0.707+j0.707}, using FFT Algorithm. (CO1)

5. Answer any <u>one</u> of the following:-

5-a. Design a Chebyshev analog filter with a maximum passband attenuation of 2.5 dB at pass band frequency equal to 20 rad/s and a minimum stop band attenuation of 30 dB at frequency 50 rad/s. (CO2) 10

5-b. The following specification are given below: 10

(a) Passband cutoff frequency: =1

(b) Passband attenuation: =0.5 dB

(c) Stopband cutoff frequency: =2.33

(d) Stopband attenuation: =22 dB

Compute the filter order and cut off frequency of Chebyshev filter and Butterworth filter. (CO2)

6. Answer any <u>one</u> of the following:-

6-a. The desired response of a low pass filter is 10

$H_d(e^{j\omega}) = e^{-j3\omega}$, $-3\pi/4 \le w \le 3\pi/4$

0 , $3\pi/4 \le |w| \leqslant \pi$

Determine $H(e^{j\omega})$ for M=7 using a hamming window. (CO3)

6-b. Define coefficient quantization error in digital filter. Also explain quantization of fixed-point and floating-point numbers. (CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. With the help of suitable example, briefly explain Canonic and non-Canonic structure used in digital system. Also define equivalent structures. (CO4) 10

7-b. Draw the cascade and parallel form realizations of digital filter. (CO4) 10

$$H(z) = \frac{(2z+4)}{(z-0.1)(z+0.4)(z+.05)}$$

8. Answer any <u>one</u> of the following:-

8-a. With the help of suitable example, briefly explain the time domain property of interpolation process. (CO5) 10

8-b. Briefly explain the gradient adaptive lattice method used in adaptive signal processing. (CO5) 10