



**K. K. Wagh Institute of Engineering Education & Research, Nashik**  
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:IV
Class:SY	Program:B.Tech
Branch Code:ETC	Pattern:2022
Name of Course:Digital Signal Processing	Course Code:ETC222011
Max. Marks:60	Duration:2.30 Hrs.

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains two page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

**Question No. 1 Attempt following Question**

- 1a) Perform The Following Operations On The Given Signal  $x(n)=\{2,4,6,3,1\}$  (6) CO1
- i)  $x(n-2)$  ii)  $2x(n)$  iii)  $x(4n)$

**Question No. 2 Attempt following Question**

- 2a) Check Whether the Following System Is Linear, Time-Invariant & Memory (6) CO2
- $Y(n)=x(n-1)+20$

**Question No. 3 Attempt following Question**

- 3a) Determine which of the Following Pairs of Vectors are orthogonal (8) CO3
- i)  $a_1 = [-2,1,3,-1,1]$  &  $b_1 = [4,-1,0,-1,8]$
- ii)  $a_2 = [1,3,-2,2,4]$  &  $b_2 = [5,2,-3,-1,2]$
- iii)  $a_3 = [1,3,-2,-2,4]$  &  $b_3 = [3,2,-3,-1,2]$
- iv)  $a_4 = [1,3,-3,2,-1]$  &  $b_4 = [-4,1,-3,-2,4]$

**OR**

- 3b) Obtain DIFT For Following Signals **8 Marks** (8) CO3
- i)  $x(n)=\delta(n)$  ii)  $x(n)=A \quad 0 \leq n \leq -1$

=0 otherwise

- 3c) State & Prove Parseval's Energy Theorem if  $x(k) = \{10, -2, 0, 2\}$  (8) CO3

**OR**

- 3d) Perform Circular Convolution on the Given Two Periodic Sequences (8) CO3

$x_1(n) = \{1, 2, 3, 4\}$ ,  $x_2(n) = \{4, 1, 1, 2\}$  Using Concentric Circular Method.

**Question No. 4 Attempt following Question**

- 4a) Determine  $X(k)$  Using DIT FFT Algorithm For a Given Sequence (8) CO4

$x(n) = 2^n$  Where  $N=4$

**OR**

- 4b) Compute The 4 Point DIF -FFT Algorithm of The following Sequence  $x(n) = \{1, 2, 3, 4\}$  (8) CO4

- 4c) Determine IDFT Using DIT -FFT of the given sequence (8) CO4

$X(k) = \{10, -2+2j, -2, -2-2j\}$

**OR**

- 4d) Write Short Note On: (8) CO4

- 1) Computational Complexity of FFT Algorithm
- 2) Memory Requirement & In-place Computation

**Question No. 5 Attempt following Question**

- 5a) With reference to following parameters compare between Butter worth filter & Chebyshev filter. Parameters are: 1) Frequency Response 2) Order of Filter 3) Transmission Band 4) Phase Response 5) Poles of Transfer Function 6) System Function (8) CO5

**OR**

- 5b) If  $H_a(s) = 1/(s+1)(s+2)$  Find the corresponding  $H(z)$  (8) CO5

Using Impulse Invariance Method for sampling frequency of 5 Sample/Sec.

- 5c) Design an ideal low pass filter using hamming window, the filter coefficients are given as  $h_d(n) = \sin(\pi/2 n) / (\pi n)$  for  $n \leq 3$  and length of filter  $N=7$ . Find  $H(z)$  and  $H'(z)$ . (8) CO5

**OR**

- 5d) Explain Gibb's Phenomenon? How it can be reduced? Comment on Selection of Windows? (8) CO5

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