

Develop DIT FFT algorithms for decomposing the DFT for $N=6$ and draw the flow diagrams for $N=2,3$.

Unit-V

5. a) Use the backward difference for the derivative to convert the analog low-pass filter with system function.

$$H(s) = \frac{1}{s+2}$$

- b) Write the advantages of bilinear transformation.
c) Using impulse invariant transformation convert the following analog filter transfer function to digital filter transfer function, by taking sampling time, $T=1$ second.

$$H(s) = \frac{s+0.1}{(s+0.1)^2 + 9}$$

- d) Write the differences between IIR and FIR filters.

OR

Explain the procedure for designing an FIR filter using the Kaiser window.

Roll No

EC-603

B.E. VI Semester

Examination, June 2016

Digital Signal Processing

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

Unit-I

1. a) Test, whether the system $y[n] = x[-n+2]$ is linear or non-linear.
b) Determine the response of the system

$$y[n] = \frac{1}{3} [x(n+1) + x[n] + x(n-1)] \text{ to the input signal}$$

$$x[n] = \begin{cases} |n|, & -3 \leq n \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

- c) Check, whether the discrete time system, $y(n) = ny(n-1) + x(n)$, $n \geq 0$ is at rest [i.e. $y(-1)=0$]. is L.T.I. or non L.T.I.

[2]

- d) Determine the response $y[n]$, $n \geq 0$ of the system described by the 2nd order difference equation.

$$y[n] - 3y[n-1] - 4y[n-2] = x[n] + 2x[n-1]$$

to the input $x[n] = 4^n u[n]$

OR

Determine the impulse response of the following causal system. $y[n] - 3y[n-1] - 2y[n-2] = x[n] + x[n-1]$

Unit-II

2. a) Determine the Z-transform of the system.

$$x[n] = \begin{cases} \left(\frac{1}{2}\right)^n, & n \geq 5 \\ 0, & n \leq 4 \end{cases}$$

- b) Obtain inverse Z-transform using residue method, where $x[z] = 10z/(z-1)(z-2)$
- c) Determine the response of the system characterized by impulse response $h[n] = (0.5)^n u[n]$ to the I/P signal $x[n] = u[-n]$
- d) Determine the response $y[n]$ of the system characterized by second order difference equation $y[n] - 4y[n-1] + 4y[n-2] = x[n] - x[n-1]$ when the input is $x[n] = (-1)^n u[n]$ and initial conditions are $y[-1] = y[-2] = 0$

OR

Find the linear convolution of $x_1(n)$ and $x_2(n)$ using Z-transform.

$$x_1[n] = \begin{cases} \left(\frac{1}{3}\right)^n, & n \geq 0 \\ \left(\frac{1}{3}\right)^{-n}, & n < 0 \end{cases} \quad \text{and} \quad x_2[n] = \left(\frac{1}{2}\right)^n u[n]$$

[3]

Unit-III

3. a) Obtain the value of $x(4)$ for 8 point DFT, if $x[n] = \{1, -1, 0, 2, 1, -2, -1, 1\}$
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- b) State the periodicity property of DFT.
- c) Suppose we are given the following information about a signal $x[n]$
- $x[n]$ is real and even signal
 - $x[n]$ has period $N = 10$ and Fourier coefficient a_k
 - $a_{11} = 5$

iv) $\frac{1}{10} \sum_{n=0}^9 |x[n]|^2 = 50$

show that $x[n] = A \cos(Bn + c)$, and specify the numerical values of the constant A, B and C.

- d) Perform circular convolution of the following two sequences: $x_1[n] = \{1, 2, 2, 1\}$ and $x_2[n] = \{2, 1, 1, 2\}$

OR

Find the DFT of the sequence:

$$x[n] = \begin{cases} \left(\frac{1}{3}\right)^n, & n = 0, 2, 4, \dots \\ 0, & \text{otherwise} \end{cases}$$

Unit-IV

4. a) What are the advantages of FFT algorithm over direct computation?
- b) What is decimation-in-frequency FFT algorithm?
- c) Explain Goertzel algorithm.
- d) Draw and explain the basic butterfly diagram or flowgraph of DIT radix-2 FFT.

OR