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.

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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

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

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

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

d) Determine the response y[n], $n \geq 0$ of the system described by the 2^{nd} 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 $x[n] = (-1)^4\, u[n]$
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.

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

Unit-III

3. a) Obtain the value of $x(4)$ for 8 point DFT, if
$x[n] = \{\underset{\uparrow}{1}, -1, 0, 2, 1, -2, -1, 1\}$

b) State the periodicity properly of DFT.

c) Suppose we are given the following information about a signal $x[n]$
i) $x[n]$ is real and even signal
ii) $x[n]$ has period N = 10 and Fourier coefficient a_k
iii) $a_{11} = 5$
iv) $\frac{1}{10}\sum_{n=0}^{a} |x[n]|^2 = 50$

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:

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

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