Obtain DFT of a sequence $x[n]=\left\{\frac{1}{2},\frac{1}{2},\frac{1}{2},\frac{1}{2},0,0,0,0\right\}$ using decimation-in-frequency FFT algorithm.

Unit - V

5. a) An analog filter has the following system function. Convert this filter into a digital filter using backward difference for the derivative

$$H(s)=\frac{1}{(s+0.1)^2+9}$$

b) Convert the analog filter into a digital filter whose system function is $H(s)=\frac{s+0.2}{(s+0.2)^2+9}$

Use the impulse invariant technique. Assume T = 1s.

c) Convert the analog filter with system function

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

into a digital IIR filter using bilinear transformation. The digital filter should have a resonant frequency of $\omega_r=\frac{\pi}{4}$.

d) Describe the Butter worth filters.

OR

Describe Chebyshev filters.

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Roll No .....

EC-603

B.E. VI Semester

Examination, December 2015

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 $y[n]=x[n]\cos(\omega_0 n)$ is linear or nonlinear.

b) Determine the range of values of a and b for which the L.T.I. system with impulse response.

$$h[n]=\begin{cases}a^n, & n\geq 0\\ b^n, & n<0\end{cases}$$ is stable

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

d) Determine the zero input response of the system described by the 2nd order difference equation.

$x[n]-3y[n-1]-4y[n-2]=0$

OR

Determine the particular solution of the difference equation

$$y[n]=\frac{5}{6}y[n-1]-\frac{1}{6}y[n-2]+x[n]$$

When the forcing function is $x[n]=2^n u[n]$

Unit - II

2. a) Determine the Z-transform of the signal,

$x[n]=\{3,0,0,0,0,6,1,-4\}$

↑

b) Obtain inverse Z-transform using residue method of the signal

$$X[Z]=\frac{1}{(Z-1)(Z-3)}$$

c) Determine the response of the system characterized by impulse response $h[n]=(0.5)^n u[n]$ to the input signal

$x[n]=2^n u[n]$

d) Determine the unit step response of the system characterized by the difference equation

$y[n]=0.6y[n-1]-0.08y[n-2]+x[n]$

OR

Find the linear convolution of $x_1[n]$ and $x_2[n]$ using z-transform

$x_1[n]=\{1,2,3,4\}$ and $x_2[n]=\{1,2,0,2,1\}$

↑ ↑

Unit - III

3. a) Compute the DFT of the following finite length sequence of length N, (N is even)

$$x[n]=\begin{cases}1, & 0\le n\le \frac{N}{2}-1\\ 0, & \frac{N}{2}\le n\le N-1\end{cases}$$

b) State and prove the linearity property of DFT.

c) Let x[n] be a real and odd periodic signal with period N = 7 and Fourier coefficients a_k. Given that $a_{15}=j$, $a_{16}=2j$, $a_{17}=3j$.
Determine the values of a_0, a_{-1}, a_2 and a_{-3}.

d) Prove that the multiplication of two DFT's is equivalent to the circular convolution of their sequences in time domain.

OR

Using graphical method, obtain a 5-point circular convolution of two discrete time signals defined as:

$x[n]=(1.5)^n u[n]$, $0\le n\le 2$

$y[n]=(2n-3)u[n]$, $0\le n\le 3$

Unit - IV

4. a) State the computational requirements of FFT.

b) What is decimation-in-time FFT algorithm?

c) Explain the Goertzel algorithm.

d) Develop a radix-3 DIT FFT algorithm for evaluating the DFT for N= 9.

OR