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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 16EC5DCDSP **Max Marks: 100**
Course: Digital Signal Processing **Date: 27.02.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Chebyshev filter table may be provided.

UNIT - I

1 a) Compute the 4-point DFT of the sequence x(n) = cosπn = { 1, -1, 1, -1} **06**

b) Compute the 4-point circular convolution for the sequences $x_1(n)=\{2,1,2,1\}$ and $x_2(n)=\{1,2,3,4\}$ **06**

c) Consider the finite length sequence **08**
$x(n)=\delta(n)+2\delta(n-5)$
i) Find the 10 point DFT of x(n)
ii) Find the sequence that has a DFT;
$Y(K) = e^{j\frac{2K2\pi}{10}} X(K)$
iii) Find the 10 Point Sequence y(n) that has a DFT Y(K)=X(K)W(K) Where X(K) is the 10-point DFT of x(n), and W(K) is the 10 point DFT of w(n) give by
w(n) = 1 for $0 \le n \le 6$
= 0 otherwise

OR

2 a) Find the N point DFT of the sequence **06**
$X(n) = 4 + \cos^2(2\pi n/N)$ for n=0, 1, ------- N-1

b) Find 10 point inverse DFT of **08**
X(K)= 3 for k=0
= 1 for $1 \le k \le 9$

c) Let $x_1(n)$ and $x_2(n)$ be the N-point sequences with N-point DFTs $X_1(K)$ and $X_2(K)$ respectively. Find an expression for the N-point DFT of the product $x(n)=x_1(n)*x_2(n)$ in terms of $X_1(K)$ and $X_2(K)$. **06**

UNIT - II

3 a) Determine the Output y(n) of a filter whose impulse response is h(n)={1, 1, 1} and input signal x(n)={3,-1,0,1,3,2,0,1,2,1} using **12**
i) Overlap Save Method
ii) Overlap Add Method
Assume Block Length N=5

b) Derive the relation between DFT and Z-transform. **08**

UNIT - III

4 a) Find the DFT of the following sequence using DIT-FFT algorithm and draw the flow graph indicating the intermediate values of the graph **10**

b) Find the 4 Point circular convolution of x(n) and h(n) given using DIF-FFT and Inverse DIF-FFT algorithm. **10**

x(n)={ 1,1,1,1 } and h(n)= { 1, 0, 1, 0 }

UNIT - IV

5 a) For the given specification α_p=3 dB, α_s=15 dB; Ω_p=1000 rad/sec and Ω_s=500 rad/sec. Design a highpass filter. **08**

b) For the analog transfer function $H(S) = \frac{2}{(S+1)(S+2)}$ **08**

Determine H(Z) using Impulse invariance method. Assume T=1 second

c) Obtain the cascade form realization structure for the system function **04**

$$H(z) = \frac{1+\frac{1}{4}Z^{-1}}{(1+\frac{1}{2}Z^{-1})(1+\frac{1}{2}Z^{-1}+\frac{1}{4}Z^{-2})}$$

OR

6 a) Design and realize a digital LPF using BLT to meet the following specifications **08**

i) Monotonic passband and stopband
ii) -3dB cutoff at 0.5π rad
iii) -15dB` attenuation at 0.75π rad

b) The Digital LPF is to be designed that has a passband cutoff frequency ω_p=0.375 with $\delta_p = 0.01$ and a stopband cutoff frequency ω_s=0.5π with $\delta_s = 0.01$. The filter is to be designed using BLT. What order of the butterworth and Chebyshev filter are necessary to meet the design specification. **08**

c) Given $|H_a(j\Omega)|^2 = \frac{1}{1+64\Omega^6}$ Determine the analog filter system function $H_a(S)$ **04**

UNIT - V

7 a) Design a low pass digital filter to be used in an A/D –H(Z)-D/A structure that will have a -3 dB cutoff at 30π rad/sec and an attenuation of 50 dB at 45π rad/sec. The filter is required to have a linear phase and the system will use a sampling rate of 100 samples/sec. Determine the frequency response of a resultant filter. **08**

b) Design a lowpass FIR Filter using frequency sampling technique using cutoff frequency of π/2 rad/sec. The filter should have linear phase and length of 17. **08**

c) Compare IIR and FIR filters. **04**

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