CBCS SCHEME

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15EE63

Sixth Semester B.E. Degree Examination, Jan./Feb.2021
Digital Signal Processing

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Find 8 point DFT of $x[n]=[1,2,2,1]$ using direct computation, plot magnitude and phase response. **(10 Marks)**

b. State and prove convolution property of DFT. **(06 Marks)**

OR

2 a. Using Stockham's method, find circular convolution of the sequences, $x(n)=\delta(n)+3\delta(n-1)+2\delta(n-2)+4\delta(n-3)$ and $h(n)=n$ for $0\le n\le 3$. **(08 Marks)**

b. Determine the response of an LTI system with $h(n)=[1,2]$ for an input sequence, $x(n)=[1,2,-1,2,3,-2,-3,-1,1]$. Employ overlap and add method. Use 4 point circular convolution. **(08 Marks)**

Module-2

3 a. Compute 8 point DFT of the sequence $x[n]=[1, 2, 3, 4, 4, 3, 2, 1]$ using DIT-FFT algorithm. **(08 Marks)**

b. Develop 8 point DIT-FFT radix-2 algorithm and explain basic butterfly. **(08 Marks)**

OR

4 a. Find IDFT of the sequence, $X[K]=[14,\ -1+j0.414,\ -j2,\ -1-j2.414,\ -2,\ -1-j2.414,\ j2,\ -1-j0.414]$ Using inverse DIF-FFT algorithm. **(10 Marks)**

b. What is in place computation? What is the total number of complex additions and multiplications required for N = 512 points, if DFT is computed directly and if FFT is used. **(06 Marks)**

Module-3

5 a. Design an analog filter with flat response in the passband and an acceptable attenuation of −2db at 20 radians/second. The attenuation in the stopband should be more than 10 db beyond 30 radians/sec. **(10 Marks)**

b. Derive an expression for order and cutoff frequency of the butterworth filter. **(06 Marks)**

OR

6 a. The system function of an analog filter is given as, $H_a(s)=\frac{1}{(s+1)(s+2)}$. Obtain H(z) using impulse invariant transformation. Take sampling frequency of 5 samples/sec. **(06 Marks)**

b. Explain bilinear method of transforming an analog filter into digital filter. Also show the mapping from s to z plane. **(06 Marks)**

c. Starting from a lowpass butterworth prototype analog filter, design butterworth bandpass analog filter with upper and lower band edge frequencies 10 rad/sec and 5 rad/sec. **(04 Marks)**

Module-4

7 a. Bring out the comparison between Butterworth and Chebyshev filter. (04 Marks)

b. The specifications of a lowpass filter are given as,

$0.8 \le |H(w)| \le 1$ for $0 \le w \le 0.2\pi$.

$|H(w)| \le 0.2$ for $0.32\pi \le w \le \pi$

Design the Chebyshev filter using bilinear transforms. (12 Marks)

OR

8 a. What is prewarping? Why is it required? (04 Marks)

b. Obtain the direct form I, direct form II cascade and parallel form realization for the following system:

$y(n) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. (12 Marks)

Module-5

9 a. The desired frequency response of the low pass filter is given by,

$$H_d(e^{jw}) = H_d(w) = \begin{cases} e^{-j3w}; & |w| < \frac{3\pi}{4} \\ 0; & \frac{3\pi}{4} < |w| < \pi \end{cases}$$

Determine the frequency response of the FIR filter if the hamming window is used with N = 7. (10 Marks)

b. Explain the design of an FIR filter based on frequency sampling approach. (06 Marks)

OR

10 a. Write the analytical equations and draw the magnitude response characteristics of any four different windows used in design of FIR filter. (08 Marks)

b. Realize the following system function in direct and cascade form:

$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$. (08 Marks)

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