CBCS SCHEME

USN 17EC52

Fifth Semester B.E. Degree Examination, Dec.201 171.ili.2020
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Show that finite duration sequence of length L can be reconstructed from the equidistant N samples of its Fourier transform, where N ?_ L. **(06 Marks)**

b. Compute the 6 - point DFT of the sequence x(n) -- 11, 0, 3, 2, 3, 0}. **(08 Marks)**

c. Find the N-point DFT of the sequence $x(n) = a^n$, 0 _.. n __ N - 1. **(06 Marks)**

OR

2 a. Determine the 6-point sequence x(n) having the DFT

X(K) = { 12, -3- 0 , 0, 0, 0, -3+ jJ } **(08 Marks)**

b. Derive the equation to express z - transform of a finite duration sequence in terms of its N-point DFT. **(06 Marks)**

c. Compute the circular convolution of the sequences On) = {1, 2, 2, 11 and x2(n) = 1-1, -2, -2, -11. **(06 Marks)**

Module-2

3 a. State and prove the modulation property (multiplication in time-domain) of DFT. **(06 Marks)**

b. The even samples of an eleven-point DFT of a real sequence are : X(0) = 8, X(2) = -2 + j3, X(4) = 3 -j5, X(6) = 4 + j7, X(8) = -5 - j9 and X(10) = ,,,]S - j2. Determine the odd samples of the DFT. **(06 Marks)**

c. An LTI system has impulse response h(n) = {2, 1, -1}. Determine the output of the system for the input x(n) = 11, 2, 3, 3, 2, 11 using circular convolution method. **(08 Marks)**

OR

4 a. State and prove circular time reversal property of DFT. **(06 Marks)**

b. Determine the number of real multiplications, real additions, and trigonometric functions required to compute the 8-point DFT using direct method. **(04 Marks)**

c. Find the output y(n) of a filter whose impulse response is h(n) = {1, 2, 11, and the input is x(n) = {3, -1, 0, 1, 3, 2, 0, 1, 2, 11 using overlap - add method, taking N = 6. **(10 Marks)**

Module-3

5 a. Compute the 8-pont DFT of the sequence x(n) = cos(Tcn/4), 0 n 7, using DIT-FFT algorithm. **(10 Marks)**

b. Given x(n) = 11, 2, 3, 41, compute the DFT sample X(3) using Goestzel algorithm. **(06 Marks)**

c. Determine the number of complex multiplications and complex additions required to compute 64-point DFT using radix.2 FFT algorithm. **(04 Marks)**

17EC5:

OR

6 a. Determine the sequence x(n) corresponding to the 8-point DFT X(K) = (4, 1—j2.414, 0, 1—j0.414, 0, 1+j0.414, 0, 1+j2.414} using DIF-FFT algorithm. (10 Marks)

b. Draw the signal flow graph to compute the 16-point DFT using DIT-FFT algorithm. (04 Marks)

c. Write a short note on Chirp—z transform. (06 Marks)

Module-4

7 a. Draw the direct form I and direct form II structures for the system given by :

$$H(z)=\frac{z^{-I}-3z^{-2}}{1+4z^{-1}+2z^{-2}-0.5z^{-3}}$$ (08 Marks)

b. Design a digital Butterworth filter using impulse—invariance method to meet the following specifications :

0.8 .IFI(co)I__1, (:4 (o< 0.2n

IH(6))1 0.2, 0.67c 5.. o)

Assume T = 1. (12 Marks)

OR

8 a. Draw the cascade structure for the system given by :

$$H(z)=\frac{(z-1)(z-3)(z^2+5z+6)}{(z^2+6z+5)(z^{-}-6z+8)}$$ (08 Marks)

b. Design a type-1 Chebyshev analog filter to meet the following specifications :

H(Q) I dB 5. 0, 0 f2 < 1404R rad/sec

H(n) I dB —60, SI 8268nrad/sec (12 Marks)

Module-5

9 a. Realize the linear phase digital filter given by :

$$H(z)=1+\frac{1}{2}z^{-I}+\frac{1}{3}z^{-2}+\frac{2}{5}z^{-3}+\frac{1}{3}z^{-4}$$ (06 Marks)

b. List the advantages and disadvantages of FIR filter compared with IIR filter. (04 Marks)

c. Determine the values of h(n) of a detail low pass filter having cutoff frequency coc = 7E/2 and length M = 11. Use rectangular window. (10 Marks)

OR

10 a. An FIR filter is given by : $y(n) = x(n)+\frac{2}{5}x(n-1)+\frac{3}{4}x(n-2)+\frac{1}{3}x(n-3)$. Draw the Lattice structure. (06 Marks)

b. Determine the values of filter coefficients h(n) of a high—pass filter having frequency response :

$H_d(e^{""}) = 1$, $\frac{it}{4}$ 1 o) It

$=0$, IwI< $\frac{}{4}$

Choose M = 11 and use Hanning windows. (10 Marks)

c. Write the time domain equations, widths of main lobe and maximum stop band attenuation of Bartlett window and Hanning window. (04 Marks)