Fifth Semester B.E. Degree Examination, June/July 2019
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. Describe the process of frequency domain sampling and reconstruction of discrete time signals. **(10 Marks)**

b. Using linearity property find the DFT of the sequence $x(n) = \cos\left(\frac{\pi n}{4}\right) + \sin\left(\frac{\pi}{2}n\right)$ consider N =4. **(06 Marks)**

OR

2 a. State and prove the i) circular time shift ii) circular time reversal properties of DFT. **(08 Marks)**

b. Solve by concentric circle or graphical method to find circular convolution $x(n) = \{1, 3, 5, 3\}$ and $h(n) = \{2, 3, 1, 1\}$. **(04 Marks)**

c. Derive the expression for the relationship of DFT with Z – transforms. **(04 Marks)**

Module-2

3 a. State and prove the following properties :

i) Circular correlation

ii) Parseval's theorem. **(06 marks)**

b. Consider a FIR filter with impulse response $h(n) = \{3, 2, 1, 1\}$. If the input is $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$. Find the output use overlap – same method. Assuming the length of block is 9. **(10 Marks)**

OR

4 a. Explain the linear filtering of long data sequences using overlap-add method. **(08 marks)**

b. An FIR filter has the impulse response of } $h(n) = \left\{\underset{\uparrow}{1}, 2, 3\right\}$. Determine the response of the filter to the input sequence $x(n) = \left\{\underset{\uparrow}{1}, 2\right\}$ use DFT and IDFT and verify the result using direct computation of linear convolution. **(08 Marks)**

Module-3

5 a. Develop DIT–FFT algorithm and obtain the signal flow diagram for N = 8. **(08 Marks)**

b. Determine the IDFT of $X(K) = \{4, 1 - j2.414, 0, 1 - j0.414, 0, 1 + j0.414, 0, 1 + j2.414\}$ using inverse – radix 2 DIT – FFT algorithm. **(08 Marks)**

OR

6 a. Define chirp Z–transform. What are the applications of chirp–Z transform. **(04 Marks)**

b. The DFT of the following sequence using DIF – FFT algorithm $x_1(n) = \{1, 1, 1, 0, 0, 1, 1, 1\}$ (ii) using the results in (i) Find DFT of signal $x_2(n) = \{1, 1, 1, 1, 1, 0, 0, 1\}$ consider N = 8. **(12 Marks)**

Module-4

7 a. Obtain the direct form I, direct form II, cascade and parallel form realization for the following system. $y(n) = 0.75y(n-1) - 0.125y(n-2) + 6x(n) + 7x(n-1) + x(n-2)$. **(08 Marks)**

b. Realize the system given by the difference equation :
$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252\,x(n-2)$
Use parallel form. Is this system stable? Determine its impulse response. **(08 Marks)**

OR

8 a. Design an IIR digital filter that when used in the prefilter A/D – H(z) – D/A structure will SATISFY the following equivalent along specifications. **(10 Marks)**
 i) LPF with –1dB cutoff at 100π rad/sec
 ii) stopband attenuation of 35dB or greater at 1000π rad/sec.
 iii) monotonic stop band and pass band
 iv) sampling rate of 2000 samples/sec.

b. Obtain H(z) using impulse invariance method for the following analog filter 5Hz samplin frequency $H_a(S) = \dfrac{2}{(S+1)(s+2)}$. **(06 Marks)**

Module-5

9 a. Realize a linear phase FIR filter with the following impulse response.
$h(n) = \sigma(n) + \frac{1}{4}\sigma(n-1) - \frac{1}{8}\sigma(n-2) + \frac{1}{4}\sigma(n-3) + \sigma(n-4)$. **(06 Marks)**

b. Consider a 3–stage FIR lattice structure having the coefficients $K_1 = 0.65$, $K_2 = -0.34$, $K_3 = 0.8$. Evaluate its impulse response by tracing a unit impulse σ(n) at its input through the Lattice structure. Also, draw its direct form–1 structure. **(10 Marks)**

OR

10 a. the desired frequency response of a LPF

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

Find the impulse response h(n) using Hamming window. Determine the frequency respons of FIR filter. Consider N = 7. **(10 Marks)**

b. Explain the following terms :
 i) Hamming window
 ii) Hanning window
 iii) Bartlet window. **(06 Marks)**