USN | | | | | | | | | |

10TE52

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017

Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Use of normalized Butterworth and Chebyshev tables are not allowed.

PART – A

1 a. Find the Z-transform of the sequence $x(n) = \{0.5, 0, 0.5, 0\}$. Using Z-transform result find its DFT. **(08 Marks)**

b. Find the 5-point DFT of $x(n) = \{1, 1, 1\}$. **(05 Marks)**

c. Find IDFT for the sequence : $x(k) = \{5, 0, (1 - j), 0, 1, 0, (1 + j), 0\}$. **(07 Marks)**

2 a. Given the 8-point sequence :

$$x(n) = \begin{cases} 1, & 0 \le n \le 3 \\ 0, & 4 \le n \le 7 \end{cases}$$

compute the DFT of the sequence $x_1(n)$ using properties of DFT :

$$x_1(n) = \begin{cases} 1, & n = 0 \\ 0, & 1 \le n \le 4 \\ 1, & 5 \le n \le 7 \end{cases}.$$ **(08 Marks)**

b. Let $x(n) = \{1, 2, 3, 4\}$ with $x(k) = \{10, -2 + 2j, -2, -2 -2j\}$.
Find the DFT of $x_1(n) = \{1, 0, 2, 0, 3, 0, 4, 0\}$ using minimum number of operation. **(06 Marks)**

c. For the DFT pair shown, compute the values of the boxed quantities using appropriate properties.

$$(\boxed{x_0,}\ 3, -4, 0, 2) \overset{DFT}{\longleftrightarrow} (5, \boxed{x_1,}\ -1.28 - j3.49, \boxed{x_3,}\ 8.78 - j1.4).$$ **(06 Marks)**

3 a. Find the output $y(n)$ of a filter whose impulse response is $h(n) = \{1, -2\}$ and input signal $x(n) = \{3, -2, 4, 1, 5, 7, 2, -9\}$ using overlap – add method. Use only 5 – point circular convolution in your approach. **(06 Marks)**

b. What is the need of FFT? Determine the following for a 128 point FFT computation number of : i) Stages ii) butter files in each stage iii) butter files needed for entire computation iv) total number of complex multiplications v) total number of complex additions. **(05 Marks)**

c. Given sequence $x_1(n) = \{2, 1, 1, 2\}$ and $x_2(n) = \{1, -1, -1, 1\}$ compute the circular convolution $x_1(n) \circledast_N x_2(n)$: for N = 4 use DIT – FFT algorithm. **(09 Marks)**

4 a. Determine 8-point DFT of the real sequence $x(n) = \{1, 2, 2, 2, 1, 0, 0, 0\}$. Use DIF–FFT algorithm. **(08 Marks)**

b. What is Geortzel algorithm? obtain DF–II realization of tow pole resonator for computing DFT. **(08 Marks)**

c. What is Chrip-z signal? What are the applications of Chrip-z signal? **(04 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

5 a. Derive an expression for order and cut-off frequency of Butterworth lowpass filter. **(08 Marks)**

b. Design a Chebyshev analog lowpass filter that has –3dB cut-off frequency of 100 rad/sec and stop band attenuation of 25dB (or) grater for all radian frequencies past 250 rad/sec. Verify the design. **(12 Marks)**

6 a. Realize FIR linear phase filter for 'N' to be even. **(08 Marks)**

b. Obtain the cascade and parallel realizations of : $H(z) = \dfrac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$. **(12 Marks)**

7 a. A low pass filter has the desired frequency response :

$$H_d(\omega) = H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & 0 < \omega < \pi/2 \\ 0, & \pi/2 < \omega < \pi \end{cases}$$

Determine h(n) based on frequency sampling technique. Take N = 7. **(10 Marks)**

b. Design a FIR filter (low pass) with desired frequency response :

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & \frac{-3\pi}{4} \le \omega \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |\omega| < \pi \end{cases}$$

The Hamming window with N = 7. Also obtain frequency response. **(10 Marks)**

8 a. Design a digital filter H(z) that when used in A/D–H(z)–D/A structures gives an equivalent analog filter with the following specifications.

Passband ripple	: $\le$ 3.01 dB
Passband edge	: $\le$ 500 Hz
Stopband attenuation	: $\ge$ 15 dB
Stopband edge	: 750 Hz
Sample rate	: 2 KHz

Use bilinear transformation to design the filter on an analog system function, use Butterworth filter prototype. Also obtain difference equation. **(14 Marks)**

b. Compare IIR filter with FIR–filters. **(06 Marks)**

* * * * *