C 22583 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE (2014 SCHEME) EXAMINATION, APRIL 2017

Electronics and Communication Engineering

EC 14 604—DIGITAL SIGNAL PROCESSING

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*
Each question carries 5 *marks.*

1. (a) Find the 4-point DFT of the sequence $x[n] = \{0, 1, 2, 3\}$.

   (b) Find the output of FIR filter with input $x[n] = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1\}$ and $h[n] = \{1, 2\}$ using overlap add method.

   (c) Write and prove any four properties of Discrete Fourier Transform.

   (d) Explain the different types of number representation in digital systems.

   (e) Obtain the direct form – I and cascade form realizations of FIR systems :

   $H(z) = 1 + 2.5z^{-1} + 2z^{-2} + 2z^{-3}$.

   (f) Explain the principle of scaling to prevent overflow.

   (g) Using impulse invariance technique find H(z) with $H(s) = \frac{2}{(s+1)(s+2)}$ for T = 1 sec.

   (h) Derive the amplitude and phase response of linear phase FIR filter with symmetrical impulse response and even N.

   (i) Explain the various phases of pipelining for instructions.

   (j) Outline the important features of ADSP 21XX processor.

   (8 × 5 = 40 marks)

2. (a) Compute the eight point DFT of the given sequence $x[n] = \{1/2, 1/2, 1/2, 1/2, 0, 0, 0, 0\}$ using radix-2 DIT-FFT algorithm.

   Or

   (b) Find the 8-point inverse DFT of X[*k*] = {7, – 0.707– *j*, 0.707, – *j*, 0.707–0.707, 1, 0.707 + *j* 0.707, *j*, – 0.707 + *j* 0.707} using DIF-FFT algorithm.

3. (a) (i) Obtain the direct forms, cascade and parallel form realizations for the following system :

   $y[n] = 3/4\,y[n-1] - 1/8\,y[n-2] + x[n] + 1/3\,x[n-1]$.

   (8 marks)

Turn over

(ii) Study the behaviour of zero-input limit cycle oscillation for the system $y[n] = 0.9y[n-1] + x[n]$ for the word length of 4 bits with $x[n] = 0$ and $y[-1] = 2$. Determine the dead band of the filter.

(7 marks)

Or

(b) (i) Find the effect of co-efficient quantization on pole locations of the second order IIR filter when it is realized in direct form and cascade form. Assume word length of 3 bits excluding sign bit through rounding.

$$H(z) = \frac{1}{1 - \frac{9}{10}z^{-1} - \frac{1}{5}z^{-2}}.$$

(10 marks)

(ii) Explain the signal flow graph representation of FIR and IIR structures. (5 marks)

4. (a) (i) Design an ideal band pass filter using Hanning window. Assume order of the filter N = 9.

$$H(e^{j\omega}) = \begin{cases} 1, & \frac{\pi}{2} \le |\omega| \le \frac{3\pi}{4} \\ 0, & \text{otherwise} \end{cases}.$$

(10 marks)

(ii) What is warping effect and prewarping ? Discuss the effect of warping on amplitude and phase response.

(5 marks)

Or

(b) (i) Determine the linear phase FIR filter co-efficients $h[n]$ of length N = 15 having a symmetric unit sample response and frequency response that satisfies the condition :

$$H\left(\frac{2\pi k}{15}\right) = \begin{matrix} 1, & k = 0, 1, 2, 3 \\ 0, & k = 4, 5, 6, 7. \end{matrix}$$

(10 marks)

(ii) Give the detailed steps to design digital IIR filter using bilinear transformation technique.

(5 marks)

5. (a) Explain the architecture of TMS320 series processor with neat diagram.

Or

(b) (i) Discuss the implementation of DSP algorithms for various operations. (8 marks)

(ii) Outline the important functional blocks of FFT processors. (7 marks)

[4 × 15 = 60 marks]