No. of Printed Pages : 3

BIEL-010

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

00436

June, 2015

BIEL-010 : DIGITAL SIGNAL PROCESSING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Each question carries equal marks. Use of scientific calculator is permitted. Missing data may be suitably assumed.*

1. (a) Derive the relationship between DFT and DTFT. *4*

(b) Compute the IDFT of the sequence $X(k) = \{6, 2j - 2, -2, -2j - 2\}$. *6*

2. (a) Compute the four point DFT of the sequence $x(n) = \{0, 1, 2, 3\}$ using linear transformation matrix. *5*

(b) The first five points of 8 point DFT are $X(k) = \{4, 1 - 1{\cdot}2414j, 0, 1 - 0{\cdot}414j, 0\}$. Find the remaining three points. *5*

3. Draw the butterfly line diagram for 8 point DIT FFT calculations and briefly explain the algorithm. *10*

4. What are twiddle factors for the DFT ? Also explain their significance. *10*

5. Design a digital Chebyshev filter to meet the following specifications :

$$0{\cdot}707 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq 0{\cdot}25\,\pi$$

$$|H(e^{j\omega})| \leq 0{\cdot}3 \qquad 0{\cdot}45\,\pi \leq \omega \leq \pi$$

using bilinear transformation method. *10*

6. Derive the relation to calculate the number of poles in digital Butterworth filter. *10*

7. The desired frequency response of a low-pass filter is equal to

$$H_j(e^{j\omega}) = \begin{cases} e^{-j3\omega} & -\frac{-3\pi}{4} \leq \omega \leq \frac{3\pi}{4} \\ 0 & \frac{3\pi}{4} \leq |\omega| \leq \pi \end{cases}.$$

Design the filter using Hamming window function. Also find its frequency response. *10*

8. (a) What is meant by frequency warping effect ? What is the cause of this effect ? *5*

(b) What do you understand by Gibb's phenomenon ? Explain. *5*

9. Realize the following function using least number of multipliers :

(i) $H(z) = \left(H\frac{1}{2}z^{-1} - z^{-2}\right)\left(1 - \frac{1}{4}z^{-1} + z^{-2}\right)$ *5*

(ii) $H(z) = \left(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2} + z^{-3}\right)$ *5*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) Chirp Z Transform

(b) Impulse Invariance Method

(c) Computation Efficiency of FFT