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BIEL-010

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

Term-End Examination

00788

December, 2014

BIEL-010 : DIGITAL SIGNAL PROCESSING

Time : 3 hours *Maximum Marks : 70*

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

1. (a) State any four important properties of DFT. *4*

(b) Plot the magnitude and phase spectrum of sampled data sequence x(n) = {2, 0, 0, 1}, which is obtained using sampling frequency of 20 kHz. Select N = 4. *6*

2. Consider the discrete time sequence

$x_1(n) = \{0, 1, 2, 3, 4\}$

$x_2(n) = \{0, 1, 0, 0, 0\}$

Compute $Y(k) = X_1(k) \cdot X_2(k)$. *10*

3. Compute the FFT for the sequence $x(n) = n^2 + 1$, where N = 8 using DIF FFT algorithm. *10*

4. Discuss the computational efficiency of radix-2 FFT algorithm. *10*

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

$$0{\cdot}8 \leq |H(e^{j\omega})| \leq 1 \qquad 0 \leq \omega \leq 0{\cdot}2\,\pi$$

$$|H(e^{j\omega})| \leq 0{\cdot}2 \qquad 0{\cdot}6\,\pi \leq \omega \leq \pi$$

Use bilinear transformation method. *10*

6. What are the different types of window functions used in the design of FIR filters ? How are they defined ? *10*

7. Obtain the transformation formula for bilinear transformation to convert an analog filter into a digital filter. *10*

8. A filter is to be designed with the following desired frequency response :

$$H_j(e^{j\omega}) = \begin{cases} 0 & -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ e^{-j2\omega} & \frac{\pi}{4} \leq |\omega| \leq \pi \end{cases}$$

Determine the filter coefficient $h_j(n)$ if the rectangular window function is provided. Also determine the frequency response of the designed filter. *10*

9. Obtain the structure of cascade realization of the following transfer functions :

(i) $H(z) = \dfrac{\left(1 - z^{-1}\right)^3}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{8}z^{-1}\right)}$ *5*

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

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

(a) Goertzel Algorithm

(b) Comparison of Butterworth and Chebyshev filter

(c) IIR filters vs FIR filters