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BIEL-010

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

00623

Term-End Examination

December, 2016

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 the time reversal property of DFT with an example. *4*

(b) Compute the eight-point DFT of the sequence $x(n) = \left\{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\right\}$ using the radix-2 decimation-in-time algorithm. *6*

2. (a) With a neat diagram, show the computation of 8-point DFT using radix-2 DIF algorithm. *6*

(b) Draw the realisation of an LTI system with input x[n] and output y[n] that satisfies the difference equation

$$y[n] - \frac{5}{2}\, y[n-1] + y[n-2] = x[n] - x[n-1].$$ *4*

3. Discuss Goertzel algorithm and state its application. *10*

4. What are linear phase filters ? State the conditions in which an FIR filter can be a linear phase filter. *10*

5. Design an FIR low pass filter satisfying the specifications

$$0{\cdot}98 < H(e^{j\omega}) < 1{\cdot}02, \quad 0 \le |\omega| \le 0{\cdot}63\pi,$$

$$-0{\cdot}15 < H(e^{j\omega}) < 0{\cdot}15, \quad 0{\cdot}65\pi \le |\omega| \le \pi.$$

By applying a Kaiser window to the impulse response $h_d[n]$ for the ideal discrete low pass filter with cut-off $\omega_c = 0{\cdot}64\pi$. *10*

6. Design a Butterworth filter using bilinear transformation method for the following specifications : *10*

$$0{\cdot}8 \le H(e^{j\omega}) \le 1; \qquad 0 \le \omega \le 0{\cdot}2\pi;$$

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

7. Determine the first 15 coefficients of FIR filters of the magnitude specification given below using frequency sampling method : *10*

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

8. Draw the realization by using direct form-II implementation of the LTI system with system function

$$H(z) = \frac{1 + \frac{5}{6} z^{-1} + \frac{1}{6} z^{-2}}{1 - \frac{1}{2} z^{-1} - \frac{1}{2} z^{-2}}.$$ *10*

9. Consider an FIR lattice filter with coefficients $k_1 = \frac{1}{2}$, $k_2 = \frac{1}{3}$, $k_3 = \frac{1}{4}$. Determine the FIR filter coefficients for the direct form structure. *10*

10. (a) Summarize the difference between overlap-save method and overlap-add method. *5*

(b) State and prove the circular convolution property of DFT. *5*