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BIEL-010

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

Term-End Examination

00733

June, 2018

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, if any, may be suitably assumed.*

1. (a) Derive the relationship between DFT and Z-transform. *4*

(b) Given a real finite length sequence,

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

y(n) is a sequence related to x(n) such that $Y(k) = W_8^{4k} X(k)$, where X(k) is a 8 point DFT of x(n). Obtain y(n). *6*

2. (a) Compute the circular convolution of the two discrete time signals which are given below : *5*

$x(n) = \{\underset{\uparrow}{1}, 1, 0, 1, 1\}$, $h(n) = \{\underset{\uparrow}{1}, -2, -3, 4\}$

(b) With the help of neat diagram explain Overlap-Save method. *5*

3. Let x(n) be a finite duration sequence of length 8 such that

$$x(n) = \{-1, 0, 2, 0, -4, 0, 2, 0\}.$$

Find X(k) using DIT FFT flow graph. *10*

4. (a) Using FFT and IFFT, determine the output of system if input x(n) and impulse response h(n) are given as under : *6*

$$x(n) = \{2, 2, 4\}, h(n) = \{1, 1\}$$

(b) With the help of neat diagram, explain Chirp Z-transform. *4*

5. Explain radix-2 DIF FFT algorithm. Compare it with DIT FFT algorithm. *10*

6. Design a Chebyshev analog filter with maximum passband attenuation of 2·5 dB at $\Omega_P = 20$ rad/sec and stopband attenuation of 30 dB at $\Omega_S = 50$ rad/sec. *10*

7. (a) The analog transfer function of low-pass filter is $H(s) = \frac{1}{s+2}$ and its bandwidth is 1 rad/sec. Design the digital filter using bilinear transformation method whose cut-off frequency is 20π and sampling time is 0·0167 sec by considering the warping effect. *6*

(b) Explain about the stability of backward difference approximation for the derivative method transformation. *4*

8. Design a band-pass filter which approximates the ideal filter with cut-off frequencies at 0·2 rad/sec and 0·3 rad/sec. The filter order is M = 7. Use the Hanning window function. *10*

9. (a) Compare the frequency domain characteristics of the different types of window functions. *6*

(b) Compare the FIR and IIR filters in detail. *4*

10. (a) Draw the cascade and parallel realization for the following system functions : *5*

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

(b) A system function is given as under

$$H(z) = \frac{2 + 8z^{-1} + 6z^{-2}}{1 + 8z^{-1} + 12z^{-2}}.$$

Realize this system function using ladder structure. *5*
