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BIEL-010

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

00213

Term-End Examination

December, 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) Explain Fourier Transform (FT). What is the relationship between Discrete Fourier Transform (DFT) and FT of a Periodic Sequence ? *4*

(b) A finite duration sequence of length L is given as $x(n) = \begin{cases} 1 , & 0 \le n \le L-1 \\ 0 & \text{otherwise} \end{cases}$

Determine the N-Point DFT of this sequence for $N \ge L$. *6*

2. (a) Evaluate the circular convolution of the signal 5

$$f(n) = \{ 1, 2, 3, 4\}$$
$$\uparrow$$
$$h(n) = \{ 4, 3, 2, 1\}$$
$$\uparrow$$

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

3. (a) Explain briefly about direct computation of DFT. 4

(b) Determine the system function H(z) and difference equation for the system that uses a Goertzel algorithm to compute the DFT value X(N – K). 6

4. Compute 8-point radix-2 DIF-FFT of the sequence

$$x(n) = \left\{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\right\}.$$ 10

5. (a) Explain basic structures for FIR systems. 5

(b) Explain briefly about Butterworth and Chebyshev filters. 5

6. Convert the analog filter with system function $Ha(s) = \frac{s + 0{\cdot}1}{(s + 0{\cdot}1)^2 + 9}$ into a digital IIR filter by means of impulse invariance method. *10*

7. (a) Write down any four window functions used in FIR filter design. *4*

   (b) Explain FIR filter design using Frequency Sampling technique. *6*

8. Determine the order and the poles of a type 1 low pass Chebyshev filter that has a 1-dB ripple in a pass band, a cut-off frequency $\Omega_p = 1000\pi$, a stop band frequency of 2000π, and an attenuation of 40 dB (or more) for $\Omega \geq \Omega_s$. *10*

9. (a) Derive the transformation formula for the bilinear transformation method. *4*

   (b) Transform the single pole low pass Butterworth filter with system function $H(s) = \frac{\Omega_p}{s + \Omega_p}$ into a band pass filter with upper and lower edge frequencies Ω_u and Ω_l respectively. *6*

10. Determine the unit sample response {h(n)} of a linear-phase FIR filter of length M = 4 for which the frequency response at $\omega = 0$ and $\omega = \pi/2$ is specified as $H_r(0) = 1$; $H_r\left(\frac{\pi}{2}\right) = \frac{1}{2}$. *10*
