JU – 842

VII Semester B.E. (E&E) Engg. Degree Examination, Jan./Feb. 2014
(2K6 Scheme)
EE-704 : DIGITAL SIGNAL PROCESSING

Time : 3 Hours Max. Marks : 100

Instruction : *Answer* ***any five full*** *questions.*

1. a) Compute the DFT of the sequence x(n) = {1, 2, 3, 4}. **6**

   b) State and prove the following properties of DFT **8**
   i) Circular time shift ii) Circular frequency shift.

   c) Compute circular convolution of the sequences $x_1(n) = \{1, 2, 0, 1\}$ and $x_2(n) = \{2, 2, 1, 1\}$. Use circular arrays. **6**

2. a) Explain the following : **6**
   i) in place computations ii) bit reverse order

   b) Derive the DIT-FFT algorithm for N = 8. Draw the resulting signal flow graph. **8**

   c) Explain chirp-z transform algorithm. **6**

3. a) Realize the following system function in parallel form **8**

$$H(z) = \frac{1-\frac{2}{3}z^{-1}}{1-\frac{7}{8}z^{-1}+\frac{3}{32}z^{-2}} \cdot \frac{1+\frac{7}{4}z^{-1}-\frac{1}{2}z^{-2}}{1-z^{-1}+\frac{1}{2}z^{-2}}.$$

   b) The difference equation of a system is y(n) – 0.75y (n – 1) – 0.125y (n – 2) = 6x (n) + 7x (n – 1) + x (n – 2) obtain cascade realization. **6**

   c) An FIR system has a system function $H(z) = 1+\frac{3}{4}z^{-1}+\frac{17}{8}z^{-2}+\frac{3}{4}z^{-3}+z^{-4}$. Obtain the cascade form and direct form of realization. **6**

4. a) Draw the frequency (amplitude)^2 characteristic of butterworth filter and derive expressions for the order 'N' and cut off frequency Ω_c. **10**

   b) Given that $|H_\alpha(J\Omega)|^2 = \frac{1}{1+64\ \Omega^6}$ determine the analog filter system function $H_a(s)$. **10**

P.T.O.

5. a) Obtain the system function of digital filter by approximation of derivatives, given the system function of the analog' filter $H_a(s) = \frac{1}{(s+0.1)^2+9}$. **4**

   b) If $H_a(s) = \frac{1}{(s+1)(s+2)}$ find H(z) by impulse invariance method. **6**

   c) Design a digital law pass filter using Chebyshev filter design procedure that meets the following specifications.

   Pass band magnitude characteristic that is constant to within 1dB for frequencies below $\omega = 0.2\pi$ and stopband attenuation of at least 15 dB for frequencies between $\omega = 0.3\pi$ and π. Use bilinear transformation. **10**

6. a) Derive Bilinear transformation. Explain its properties. **10**

   b) Design the first order low pass butterworth filter that has 3 dB cut of frequency at $\omega_c = 0.2\pi$. Use Bilinear transformation. **10**

7. a) Compute the impulse response of a linear phase FIR filter using Kaiser window for the following specifications.

   K_s = 40 dB, δ_s = 0.01 dB, frequency mid = 1000π rad/s cutoff frequency = 2400 π rad/s and sampling frequency = 10 KHz. **10**

   b) Using rectangular window technique, design a low pass filter with passband gain of unity cutt off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. The length of impulse response should be 7. **10**

8. a) Determine the impulse response h(n) of a filter having desired frequency response $H_d(e^{j\omega}) = \begin{cases} e^{-j}(N-1)\omega/2 & 0 \le |\omega| \le \pi/2 \\ 0 & \pi/2 \le |\omega| \le \pi \end{cases}$ N = 7. Use frequency sampling approach. **10**

   b) Give the blockdiagram of TMS 320 DSP processor and explain its working. **10**