Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC301

Course Name: DIGITAL SIGNAL PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) If x(n) = {2,3,4,5,6,4,3,2,1}, h(n) = {2, 3,4,5}. Find x(n)*h(n) using overlap save method. (7)

b) Find the 8 point DFT of the sequence x(n) ={ 1,2,3,4,4,3,2,1} using DITFFT radix 2 algorithm. (8)

2 a) State and prove any three properties of DFT. (7)

b) Find the 8-point DFT of the real sequence x(n) = {1,2,2,2,1,0,0,0} using decimation in frequency FFT algorithm. (8)

3 a) Find the circular convolution of $x_1(n)$ = {1,2,3,4} and $x_2(n)$ = {2, 1,2}. (5)

b) The first eight points of the 14-point DFT of a real valued sequence are [12, -1+3j, 3+j4, 1-j5, -2+j2, 6+j3, -2-j3, 10] (5)

i) Determine the remaining points.

ii) Evaluate x[0] without computing the IDFT of X(k).

c) Find the 8-point DFT of the sequence {2, 0,2,0, 2, 0, 2, 0} using 4-point DFTs. (5)

PART B

Answer any two full questions, each carries 15 marks

4 a) Find the response of the signal x(n) = 2Cos(π/2)n when applied to an FIR filter with impulse response h(n) = {1,3,1}. (5)

b) A second order linear phase FIR filter has a zero at z = ½. Obtain the magnitude and phase response of the filter. (5)

c) An all pole analog filter have transfer function H(s) = $1/(s^2+5s+6)$. Find H(z) by impulse invariance method.Assume T=1sec. (5)

5 a) Design an ideal FIR high pass filter with frequency response (7)

$$H_d(\omega) = 1 \ for \ \frac{\pi}{4} \leq |\omega| \leq \pi$$

$$0 \ for \ |\omega| \leq \frac{\pi}{4}$$

Find the value of h(n) for N=11.

b) Design a digital Butterworth filter satisfying the following constraints (8)

$$0.707 \leq \left|H(e^{j\omega})\right| \leq 1 \quad for \ 0 \leq \omega \leq \frac{\pi}{2} \quad and$$

$$\left|H(e^{j\omega})\right| \leq 0.2 \quad for \ \frac{3\pi}{4} \leq \omega \leq \pi$$

using bilinear transformation, (Assume T=1sec)

6 a) A low pass filter has the desired frequency response: (8)

$$H_d(\omega) = e^{-j3\omega} \quad for\ 0 < \omega < \frac{\pi}{2}$$

$$= 0 \quad for\ \frac{\pi}{2} < \omega < \pi$$

Determine h(n) based on frequency sampling technique.

b) For the given specification, design an analogButterworth filter (7)

$$0.9 \leq |H(j\Omega)| \leq 1 \quad for\ 0 \leq \Omega \leq 0.2\pi \quad and$$

$$|H(j\Omega)| \leq 0.2 \quad for\ 0.4\pi \leq \Omega \leq \pi$$

PART C

Answer any two full questions, each carries 20 marks

7 a) Draw the direct form-I and direct form-II structures for a system described by the difference equation $y(n) = x(n) + \frac{1}{2}x(n-1) + 3y(n-1) - 2y(n-2)$. (10)

b) Write short notes on any two finite word length effects in DSP systems with examples. (10)

8 a) Draw and explain the internal architecture of TMS320C67XX digital signal processor. (10)

b) Consider a signal $x(n) = (\frac{1}{2})^n u(n)$.Obtain the signals with: (5)

i) Decimation factor 3 ii) Interpolation factor 3

c) The signal $x(n) = (\frac{1}{2})^n u(n)$ is applied to a decimator that decimates the input signal by a factor of 2.Find the spectrum of the output and plot it. (5)

9 a) Draw the cascade form structure for a discrete time sequence described by: $\frac{1+\frac{1}{2}z^{-1}}{1-\frac{3}{4}z^{-1}+\frac{1}{8}z^{-2}}$. (5)

b) Realise a FIR system with function $H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$. (5)

c) Write short notes on finite word length effect in IIR digital filters. (10)

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