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Reg No :- Name:-

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

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) Find the 4-DFT and 8-DFT of the sequence {1, 1, 1, 0}. Plot |X(K)| and comment on the significance of N? (10)

b) State Parseval's property? (5)

DFT of a real valued signal X(K). = {j, 1+j, A, 1-j, -1, B, -1-j, C}. Find the energy of the signal?

2 a) Find the convolution of x(n) = {1, 2, 3, 4, 5, 6, 7, 8, 9} and h(n) = {2, 4, 6} using overlap add method? (6)

b) Find the response of an LTI system with impulse response h(n) = { 1, 2, 2, 1} for an input x(n) = {1 , -1 , 1, -1 } using circular convolution? (4)

c) If x(n) = {1, 2, 3, 4}. Find DFT[DFT(x(n))] without calculating DFT? (5)

3 a) Explain the radix-2 DIT FFT algorithm and draw the corresponding flow diagram for 16 DFT computation. (10)

b) Explain about the efficient computation of DFT of a 2N- point real sequence (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Derive equations for magnitude and phase responses of FIR filter whose impulse response is symmetric and length N odd. (5)

b) Design an ideal 6^{th} order linear phase lowpass filter with frequency response (6)

$H(e^{j\omega}) = 1$ for $-0.5\pi \leq \omega \leq 0.5\pi$ and $H(e^{j\omega}) = 0$ for $0.5\pi \leq |\omega| \leq \pi$.

Use Hamming window.

c) Explain Gibb's phenomenon. (4)

5 a) Determine the filter coefficients of a linear phase FIR filter of length N = 15, which has a symmetric impulse response and a frequency response that satisfies the conditions, $H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0,1,2,3 \\ 0.4, & k = 4 \\ 0, & k = 5,6,7 \end{cases}$ (10)

b) Prove that the zeros of FIR filter exists as reciprocals. (5)

6 Design a digital Butterworth filter that has -1dB pass band attenuation at 200 Hz and at least -15dB stop band attenuation at 540 Hz. Sampling frequency = 2000 Hz. Find the cut off frequency by matching pass band criterion. Use Bilinear transformation (T = 1 sec) (15)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Explain the steps through which we obtained direct form II realization of recursive LTI system described by difference equation. (10)

$$y(n) = -\sum_{k=1}^{N} a_k\, y(n-k) + \sum_{k=0}^{M} b_k\, x(n-k)$$

b) Draw the architecture block diagram of TMS320C67XX processor (5)

c) Obtain the transposed direct form II structure for the system (5)

$y(n) = 2y(n-1) + 3y(n-2) + x(n) + 2x(n-1) + 3x(n-2)$

8 a) Find the impulse response h(n) of a FIR filter, if the reflection coefficients are (6)

$K_1 = 2/5$, $K_2 = 4/21$, $K_3 = 1/8$.

b) What is transposition theorem and transposed structure? (6)

c) Obtain direct form II and cascade structure for the transfer function given below. (8)

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

9 a) Explain the effect of coefficient quantization in IIR and FIR filters? (10)

b) What are the main features of DSP processor? (5)

c) Explain the effect in the spectrum of a signal x(n) when it is (5)

(i) Decimated by a factor 3

(ii) Interpolated by a factor 2

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