Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: EE407

Course Name: DIGITAL SIGNAL PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks. Marks

1 The first five points of the 8 point DFT of a real valued sequence are $\{28,\ -4+9.565j,\ -4+4j,\ -4+1.656j,\ -4\}$. Determine the remaining three points. (5)

2 Explain transposed structure with an example. (5)

3 Describe warping effect with a diagram. (5)

4 What is the principle of designing FIR filter using frequency sampling method. (5)

5 What is meant by rounding? Explain its effect on all types of number representations. (5)

6 Express 0.875 and -0.875 in sign-magnitude, two's complement, and one's complement format. (5)

7 With a block diagram, describe Central Arithmetic Logic Unit in TMS 320 C24x in detail. (5)

8 How instruction set is classified in TMS 320 C24x processor? (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Find IDFT of the sequence (10)

$X(k)=\{4,\ 1-2.414j,\ 0,\ 1-0.414j,\ 0,\ 1+0.414j,\ 0,\ 1+2.414j\}$ using radix 2 DIF FFT algorithm.

10 a) Consider the sequence $x_1(n)=\{0,1,2,3,4\}$, $x_2(n)=\{0,1,0,0,0\}$. Determine a sequence y(n) so that $Y(K)=X_1(K)\ X_2(K)$ (5)

b) Realise the given Transfer function with minimum number of multipliers. (5)

$$H(Z)=1+\frac{1}{3}Z^{-1}+\frac{1}{4}Z^{-2}+\frac{1}{4}Z^{-3}+\frac{1}{3}Z^{-4}+Z^{-5}$$

11 Obtain direct form II, cascade form and parallel form realization of the LTI system governed by (10)

$$y(n) = \frac{-3}{8}\, y(n-1) + \frac{3}{32} y(n-2) + \frac{1}{64} y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$$

PART C

Answer any two full questions, each carries 10 marks.

12 Design a low pass Butterworth digital filter to give attenuation of 3dB or less for frequencies up to 2kHz and attenuation of 20dB or more beyond 4kHz. Use bilinear transformation and obtain H(z) of the desired filter. Given sampling interval T=0.1 millisecond. (10)

13 a) Write down the transfer function H(s) of a 3rd order Chebyshev low pass filter and cut-off frequency of 1 rad/sec. Determine H(z) by using approximation of derivative method with a sampling interval of 1 sec. (7)

b) What is the need for windowing technique for FIR filter design? (3)

14 Design a bandpass filter to pass the frequency in the range 1-2 rad/samples using Hamming window. Also find frequency response of the filter. Take N=5. (10)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Obtain the limit cycle behaviour of the system described by $y(n) = Q[ay(n-1)] + x(n)$, where $y(n)$ is the output of the filter and $Q[.]$ is the rounded operation. Assume $a = -\frac{1}{2}$, $x(0) = 0.875$ & $x = 0$, for $n > 0$ choose 4 bit including sign bit. (6)

b) Draw the product quantization noise model of IIR system with two first order sections in cascade. (4)

16 a) The output of an ADC is applied to a digital filter with system function $H(z) = \frac{0.5z}{(z-0.5)}$. Find the output noise power from digital filter when input signal is quantized to have 8 bits. (5)

b) Define any 5 branching instructions in TMS 320 C24x processor. (5)

17 Draw the internal architecture of Central Processing Unit of TMS 320 C24x processor and define each block. (10)

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