Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 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 What is the need of zero padding? Obtain linear convolution of the sequence x(n)={1,2,3},h(n)={-1,-2} using circular convolution. (5)

2 Realize the system function using minimum number of multipliers (5)

$$H(z) = (1 + Z^{-1})(1 + \tfrac{1}{2}Z^{-1} + \tfrac{1}{2}Z^{-2} + Z^{-3})$$

3 For the analog transfer function $H(s) = \frac{10}{(s^2+7s+10)}$, determine H(z) using impulse invariant method for T=0.2 sec (5)

4 Compare Hamming and Barlett windows with required equations. (5)

5 Express the fraction 7/8 and -7/8 in sign magnitude, 1's complement and 2's complement. (5)

6 What is zero input limit cycle oscillation? (5)

7 What are the different buses of TMS 320 C24x processor and their functions? (5)

8 Define any 5 arithmetic and logic instructions in TMS 320 C24x processor. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Determine the 8-point DFT of the following sequence. (10)
x(n)={0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0}.Using radix-2 decimation in time FFT algorithm.

10 a) Perform the linear convolution of the following sequence by Overlap save method. x(n) ={1,2,3,-1,-2,-3,4,5,6} and h(n)= {2,1,-1} (5)

b) Obtain direct form II realization of a system described by, (5)

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$$

11 Obtain the cascade and parallel realizations for the system function (10)

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

PART C

Answer any two full questions, each carries 10 marks.

12 Design a digital Butterworth filter satisfying the constraints: (10)

$0.9 \leq |H(e^{jw})| \leq 1$ for $0 \leq w \leq \pi/2$

$|H(e^{jw})| \leq 0.2$ for $3\pi/4 \leq w \leq \pi$,

with T=1 sec using bilinear transformation.

13 a) Write down the transfer function H(s) of a 2nd order Chebyshev low pass filter with 3 dB cut-off frequency of 1 rad/sec. Determine H(z) by using approximation of derivative method with a sampling interval of 1 sec. (6)

b) Compare IIR and FIR filters. (4)

14 Design a high pass filter with a frequency response (10)

$H(e^{jw}) = 1$, $\frac{\pi}{6} \leq |w| \leq \pi$

$= 0$, otherwise

using Hanning window. Take N=7

PART D

Answer any two full questions, each carries 10 marks.

15 a) Draw the product quantization noise model of a second order IIR system. (5)

b) Two first order filters are connected in cascade whose system functions of the individual sections are $H_1(z) = 1/(1-0.5z^{-1})$ and $H_2(z) = 1/(1-0.6z^{-1})$. Determine overall output noise power. (5)

16 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 $a = \frac{7}{8}$, $x(0) = \frac{3}{4}$ & $x = 0$, for $n > 0$ choose 4 bit sign magnitude. (5)

b) What are the functions of TREG and PREG in TMS 320 C24x processor? (5)

17 Draw and describe the functional block diagram of TMS 320 C24x processor. (10)

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