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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

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

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|----|---|------|
| 9 | Determine the 8-point DFT of the following sequence.
$x(n)=\{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$. Using radix-2 decimation in time FFT algorithm. | (10) |
| 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,
$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{2}x(n-1)$ | (5) |
| 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)
- $$0.9 \leq |H(e^{jw})| \leq 1 \quad \text{for } 0 \leq w \leq \pi/2$$
- $$|H(e^{jw})| \leq 0.2 \quad \text{for } 3\pi/4 \leq w \leq \pi,$$
- with T=1 sec using bilinear transformation.

- 13 a) Write down the transfer function H(s) of a 2nd order Chebyshev low pass filter (6)
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.
- b) Compare IIR and FIR filters. (4)
- 14 Design a high pass filter with a frequency response (10)
- $$H(e^{jw}) = 1, \quad \frac{\pi}{6} \leq |w| \leq \pi$$
- $$= 0, \quad \text{otherwise}$$
- 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 (5)
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.
- 16 a) Obtain the limit cycle behaviour of the system described by (5)
 $y(n) = Q[ay(n-1)] + x(n)$, where $y(n)$ is the output of the filter and $Q[\cdot]$ is the
rounded operation. Assume $a = \frac{7}{8}$, $x(0) = \frac{3}{4}$ & $x = 0$, for $n > 0$ choose 4 bit
sign magnitude.
- 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)
