Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2021 (2015 Scheme)

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 Explain the important aspects of linear filtering based on DSP (5)

2 Obtain Direct form-II realization of a discrete system represented by transfer function $y(n) = \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) + x(n) + x(n-1)$ (5)

3 Convert the analog filter given by transfer function $H_a(s) = \frac{3s}{S^2+0.5s+2}$ to a digital filter by using bilinear transformation for T=1s (5)

4 Explain the important steps involved in designing an FIR filter using frequency sampling technique. (5)

5 Explain about coefficient quantisation error and its effect in digital filters (5)

6 Explain different formats of fixed point and floating point representation of binary numbers. (5)

7 Explain briefly about Dual access RAM(DARAM) and Flash EEPROM in C24x processor (5)

8 Define the function of (i) Program Counter(PC) (ii) Repeat counter(RPTC) in C24x processor. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Find the 8-point DFT of the sequence x(n)= {1,2,2,3,3,4,1,1} using Decimation in Time FFT Algorithm. (10)

10 a) Perform circular convolution of the following sequences $x_1(n) = \{1,3,2,1\}$; $x_2(n) = \{2,2,3,4\}$ using (i) Concentric circle method (ii) Matrix method (5)

b) Obtain cascade realization of the system given by transfer function (5)

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

11 Obtain the lattice structure realization of the difference equation given by (10)

$$y(n) = 4x(n) + \frac{26}{12}x(n-1) + \frac{10}{4}x(n-2) + \frac{4}{3}x(n-3)$$

PART C

Answer any two full questions, each carries 10 marks.

12 (a) Find the analog transfer function of Chebyshev IIR filter for the following specifications using bilinear transformation. Take sampling time T=1s. (5)

$$\sqrt{0.5} \leq |H(\omega) \leq 1 \quad , \quad 0 \leq \omega \leq 0.2\pi$$

$$|H(\omega) \leq 0.1 \quad , \quad 0.6\pi \leq \omega \leq \pi$$

(b) With relevant equations, explain Bartlett and Blackman windows (5)

13 Design a Butterworth IIR digital filter with the following specifications using bilinear transformation. Take sampling time T=1s. (10)

3dB ripple in passband $0 \leq \omega \leq 0.2\pi$

25dB attenuation in stopband $0.45\pi \leq \omega \leq \pi$

14 Design a filter with $H_d(\omega) = e^{-j3\omega}$, $-\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4}$ (10)

$$=0 \ , \qquad -\frac{\pi}{4} \leq |\omega| \leq \pi$$

Using a Hamming window with N=7

PART D

Answer any two full questions, each carries 10 marks.

15 a) For a second order IIR filter with $H(z) = \frac{1}{(1-0.8Z^{-1})(1-0.6Z^{-1})}$,Discuss the effect on pole locations of the given system function in direct form and in cascade form with 3 bit coefficient representation (b=3 bits). (5)

b) With neat diagram explain the Central Arithmetic Logic Unit in TMS 320 C24X processor. (5)

16 a) Explain any 5 control instructions in TMS 320C24x processor (5)

b) Discuss about the internal bus structure of TMS 320C24x processor (5)

17 In the IIR system given by $H(z) = \frac{1}{(1-0.4Z^{-1})(1-0.7Z^{-1})}$ the products are rounded to 4 bits (including sign bit). Find the output round off noise power in cascade realization for the order of cascading $H_1(z)H_2(z)$ (10)

Where $H_1(z) = \frac{1}{(1-0.4Z^{-1})}$ and $H_2(z) = \frac{1}{(1-0.7Z^{-1})}$

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