Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree (S, FE) Examination January 2023 (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 Compute the 4 point DFT of the sequence x(n)=cos $\frac{n\pi}{4}$ (5)

2 Develop a direct form I realisation structure of the signal given by: (5)
y(n)=$\frac{3}{4}$ y(n-1)- $\frac{1}{8}$y(n-2)+x(n)+ $\frac{1}{3}$x(n-1)

3 Explain the mapping of a point in s-plane to z-plane using impulse invariant method? Comment on the mapping of stability regions. (5)

4 Compare rectangular window and hamming window with required equations. (5)

5 Explain the methods to prevent overflow in digital filter implementation? (5)

6 Compare fixed point and floating point arithmetic. (5)

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

8 Explain the addressing modes of TMS 320C24x processor with example. (5)

PART B

Answer any two full questions, each carries 10 marks.

9 Obtain the circular convolution of $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{5, 6, 7\}$ using DFT. (10)

10 a) Suppose DFT$[x(n)] = X(k)$. Find $x(n)$ if $X(k) = \{6, -2 + j2, -2, -2 - j2\}$ using FFT algorithm. (5)

b) Explain two stage lattice ladder structure for an IIR filter with neat diagram and equations. (5)

11 Realize the cascade and parallel realization of the given filter with difference equation: $y[n] = -\frac{13}{12}y[n-1] - \frac{9}{24}y[n-2] - \frac{1}{24}y[n-3] + x[n] + 4x[n-1] + 3x[n-2]$. (10)

PART C

Answer any two full questions, each carries 10 marks.

12 a) An analog filter has transfer function $H(s) = \frac{2}{(s+1)(s+2)}$. Discretize the filter using bilinear transformation with sampling period $T = 1$ sec. Comment on the stability of the digital filter. (5)

b) What is the need for employing window technique for FIR filter design? (5)

13 Design a filter with $H(e^{jw}) = e^{-j\alpha w}$, $0 \leq |w| \leq \frac{\pi}{6}$ $= 0$, $\frac{\pi}{6} < |w| \leq \pi$ using hamming window with N=13 (10)

14 Design a Butterworth digital IIR filter using impulse invariant method by taking T=1 sec, to satisfy the following design specifications. Let Ω be the angular frequency in rad/sample. (10)

$$0.707 \leq |H(e^{j\Omega})| \leq 1.0 \quad ; \quad for \ 0 \leq \Omega \leq 0.3\,\pi,$$

$$|H(e^{j\Omega})| \leq 0.2 \quad ; \quad for \ 0.75\,\pi \leq \Omega \leq \pi.$$

PART D

Answer any two full questions, each carries 10 marks.

15 Find the output round off noise power, when the products are rounded to 5 bits (including sign bit) in cascade realization of the following IIR system (10)

$$H(z) = \frac{1}{(1 - 0.41\,z^{-1})(1 - 0.59\,z^{-1})}$$

16 With the help of neat block diagram, explain the architecture of TMS320C24x processor (10)

17 a) What is input quantization error? (5)

b) Describe the Internal Bus structure of a TMS320C24x processor (5)

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