M 02000ECT286072103 Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech (Minor) Degree Examination July 2021 (2019 admisssion)

Course Code: ECT286

Course Name: INTRODUCTION TO DIGITAL SIGNAL PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1 Obtain the fundamental period of the signal $x[n] = cos\left(\frac{8\pi n}{31}\right)$. (3)

2 Explain the function of anti-aliasing filter. (3)

3 Find the DFT of the sequence $x(n) = \{7,5,4,6\}$. (3)

4 The first five points of the eight point DFT of a real valued sequence are $\{0.25, 0.125 - j0.3018, 0, 0.125 - j0.0518, 0\}$. Determine the remaining three points. (3)

5 Explain the effect of warping in the frequency spectrum of the digital filter. (3)

6 What do you mean by Gibb's phenomenon? How can we reduce this? (3)

7 Express $(4.5)_{10}$ in floating point representation. (3)

8 Explain Truncation and Rounding. (3)

9 Explain the on-chip cache. (3)

10 Draw the block diagram of MAC unit in DSP processor. (3)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Explain analog to digital conversion operation with the help of block diagram. (10)

b) State and explain sampling theorem. (4)

12 a) Evaluate the DTFT of the signal $x[n] = 0.5^n u[n] + 2^n u[n+1]$. (5)

b) Explain any three properties of DTFT. (9)

Module -2

13 a) Compute the 2-point DFT of the sequence $x(n) = \{1, 2, 0, 3, 3, 0, 2, 1\}$ using radix-2 DIT–FFT algorithm. (10)

b) Explain how FFT reduces the computational complexity of DFT. (4)

14 a) Compute the circular convolution of $x_1(n) = \{2,1,2,1\}$ and $x_2(n) = \{1,2,3\}$ using concentric circle method and verify the result using matrix method. (9)

b) Given $X(k) = \{-6, 1+j, 0, 1-j\}$. Find the IDFT using DIF FFT algorithm. (5)

Module -3

15 a) Design a digital Butterworth filter satisfying the following constraints using bilinear transformation (10)

$$^1/_{\sqrt{2}} \leq |H(e^{jw})| \leq 1 \qquad 0 \leq w \leq {}^{\pi}/_2$$

$$|H(e^{jw})| \leq 0.2 \qquad \frac{3\pi}{4} \leq w \leq \pi$$

b) Write the expression for the Hanning window and plot it. (4)

16 a) Obtain the cascade form realization of the following system. (9)

$$H(z) = \frac{\left(1+\frac{3}{2}z^{-1}+\frac{1}{2}z^{-2}\right)\left(1-\frac{3}{2}z^{-1}+z^{-2}\right)}{\left(1+z^{-1}+\frac{1}{4}z^{-2}\right)\left(1+\frac{1}{4}z^{-1}+\frac{1}{2}z^{-2}\right)}$$

b) Write down the steps to design a digital filter using Impulse invariance method. (5)

Module -4

17 a) Derive the steady state input quantization noise power in an ADC. (8)

b) Compare fixed point and floating-point arithmetic used in DSP processors. (6)

18 a) Explain zero input limit cycle oscillations with example. (10)

b) Explain steady state output noise power. (4)

Module -5

19 a) Compare Von Neumann architecture with Harvard architecture. (8)

b) Explain the pipelining technique in a DSP processor. (6)

20 a) Explain the architecture of third generation fixed-point DSP processors TMS320C54x and DSP56300. (14)

*****