Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: AE306

Course Name: DIGITAL SIGNAL PROCESSING (AE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) State sampling theorem. What is the need for anti aliasing filter in the analog to digital conversion process? (5)

b) Find the 4 point DFT of the sequence x(n) = [1, 0,1,0]. (5)

c) Define linearity and time invariance properties of a system citing an example to each. (5)

2 a) Using decimation in time FFT, find the DFT coefficients of x[n] = {1, 2, 3, 4, 4, 3, 2, 1}. (10)

b) Calculate the minimum sampling frequency required for the signal x(t)=0.5 sin 50πt+ 0.25 sin 25πt , so as to avoid aliasing. (2)

c) Find the Discrete Time Fourier Transform of the causal signal x[n]=u[n] (3)

3 a) Explain the process of reconstruction of analog signal from the sampled signal with relevant mathematical equations. (5)

b) Prove the symmetry and periodicity properties of twiddle factor in FFT algorithm. (5)

c) Determine the Z transform and the ROC of the signal $x(n) = a^n u(n) + b^n u(-n-1)$. (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) What is linear phase FIR filter? Give different types of linear phase FIR filter. (5)

b) For the given specification, tolerance in pass band= 1dB, tolerance in stop band=30dB, Ω_p= 200 rad/sec and Ω_s =600 rad/sec. Determine the order of the Butterworth analog filter. (5)

c) Write short note on Hilbert transformers. (5)

5 a) Compare FIR and IIR filter. (5)

b) A digital band pass FIR filter with the following specification needs to be designed by window method.

Lower 3-dB cut off frequency Ω_{c1}= 200 Hz, Upper 3-dB cut off frequency Ω_{c2}

=250 Hz, Transition band at both ends=150 Hz, Stop band attenuation= -40 dB Sampling frequency=1000Hz. Select suitable window to meet the specification. Assume those data which are not given (10)

6 a) What do you meant by Gibbs phenomenon? (5)

b) For the analog transfer function H(s) = $\frac{2}{(s+1)(s+2)}$ determine H(z) in bilinear transformation. Assume T=1sec (5)

c) Apply Jury's test to determine whether the following polynomials are Schur or not. (5)

$D(z) = 2z^4 + 1.5z^3 - 3.4z^2 + 1.2z - 1.324$

PART C

Answer any two full questions, each carries 20 marks.

7 a) Realize the following FIR system function using minimum number of multipliers. (5)

$$H(z) = 1 + \frac{1}{3}z^{-1} + \frac{1}{4}z^{-2} + \frac{1}{4}z^{-3} + \frac{1}{3}z^{-4} + z^{-5}$$

b) Explain different types of number representation in DSP. (5)

c) Write notes on (10)

i. Pipelining

ii. Harward architecture

8 a) Explain about the quantization errors due to finite word length registers in digital filters. (5)

b) Write notes on (5)

i) truncation error

ii) round off error

c) Describe the operation of a typical MAC configuration in DSPs. (5)

d) List the special instructions for DSP processor. (5)

9 a) Obtain the Direct form I and Direct form II realization of the system described by the difference equation y(n) + 4y(n-1) +2y(n-2) + y(n-3) = x(n) + 3x(n-1) + 4x(n-2) + 5x(n-3) (5)

b) Write a note on superscalar architecture. (5)

c) Draw and explain the architecture of TMS320C5X. (10)

****