Reg No.:_____ **00000EC301121901** Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth semester B.Tech degree examinations (S) September 2020

Course Code: EC301

Course Name: DIGITAL SIGNAL PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

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

1 a) Compute 5 point DFT of the sequence $x(n) = \{1,1,1,1,1\}$ (5)

b) Express DFT as a linear transformation. How many complex multiplications and additions are needed to compute N point DFT. (10)

2 a) Find the 4 point circular convolution of sequences $x_1(n) = \{2,1,2,1\}$ with $x_2(n) = \{1,2,3,4\}$ (8)

b) Explain how to compute linear convolution of two sequences of length N_1 and N_2 using DFT. (7)

3 a) Derive Decimation In Time (DIT) FFT algorithm for 8 point DFT and draw the signal flow graph. (8)

b) Explain overlap and add method for filtering of long data sequences. (4)

c) Prove that N point DFT is periodic with period N (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) How the phase of a filter is related to frequency for a linear phase filter? Why linear phase is important in certain filtering applications? (5)

b) Derive the condition for impulse response $h(n)$ for getting a linear phase response. Assume length of $h(n) = N$, an even number. (10)

5 a) Derive the mapping between s and z used in bilinear transformation. (3)

b) Design a digital Butterworth filter satisfying the constraints (12)

$$0.6 \leq \left|H\left(e^{j\omega}\right)\right| \leq 1;\ 0 \leq \omega \leq 0.35\pi$$

$\left|H(e^{j\omega})\right| \leq 0.1; 0.7\pi \leq \omega \leq \pi$. Use Bilinear transformation. Assume $T = 0.1$

6 a) Give equations for N point Hamming and Hanning Window functions. Compare them in terms of main lobe width and side lobe level. (6)

b) Explain frequency sampling method of FIR filter design. (3)

c) Let $H_d(\omega) = e^{-j3\omega}; 0 \leq |\omega| \leq \frac{\pi}{2};$ (6)

$$= 0; \frac{\pi}{2} \leq \omega \leq \pi$$

Get the filter coefficients for FIR filter using frequency sampling. Assume *N*= 7.

PART C

Answer any two full questions, each carries 20 marks.

7 a) Draw the direct form 1 and direct form 2 structures for the difference equation $y(n) = x(n) + 0.5x(n-1) + 3y(n-1) - 2y(n-2)$. (10)

b) Draw the block diagram of TMS320C67xx and briefly explain function of all blocks. (10)

8 a) Explain the effects of coefficient quantization in FIR and IIR filters. (10)

b) Derive the variance of quantization noise in ADC. Assume step size is Δ. (5)

c) Let $x(n) = 0.5\,^{n}u(n)$. Obtain the signals for decimation by 3, interpolation by 3. (5)

9 a) Find the lattice structure implementation of the FIR filter with $h(n) = 1, 0.5, 0.75, -0.6$ (10)

b) Write notes on finite word length effects in DSP systems. (5)

c) Let a signal $x(n) = 0.5\,^{n}u(n)$ is decimated by 2. What happens to its spectrum? (5)

****