

Reg No :-

Name:-

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

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) Find the 4-DFT and 8-DFT of the sequence $\{1, 1, 1, 0\}$. Plot $|X(K)|$ and comment on the significance of N? (10)
- b) State Parseval's property? (5)
DFT of a real valued signal $X(K) = \{j, 1+j, A, 1-j, -1, B, -1-j, C\}$. Find the energy of the signal?
- 2 a) Find the convolution of $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ and $h(n) = \{2, 4, 6\}$ using overlap add method? (6)
- b) Find the response of an LTI system with impulse response $h(n) = \{1, 2, 2, 1\}$ for an input $x(n) = \{1, -1, 1, -1\}$ using circular convolution? (4)
- c) If $x(n) = \{1, 2, 3, 4\}$. Find $DFT[DFT(x(n))]$ without calculating DFT? (5)
- 3 a) Explain the radix-2 DIT FFT algorithm and draw the corresponding flow diagram for 16 DFT computation. (10)
- b) Explain about the efficient computation of DFT of a $2N$ - point real sequence (5)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Derive equations for magnitude and phase responses of FIR filter whose impulse response is symmetric and length N odd. (5)
- b) Design an ideal 6th order linear phase lowpass filter with frequency response (6)
 $H(e^{j\omega}) = 1$ for $-0.5\pi \leq \omega \leq 0.5\pi$ and $H(e^{j\omega}) = 0$ for $0.5\pi \leq |\omega| \leq \pi$.
Use Hamming window.
- c) Explain Gibb's phenomenon. (4)
- 5 a) Determine the filter coefficients of a linear phase FIR filter of length $N = 15$, which has a symmetric impulse response and a frequency response that satisfies (10)

$$\text{the conditions, } H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0, 1, 2, 3 \\ 0.4, & k = 4 \\ 0, & k = 5, 6, 7 \end{cases}$$

- b) Prove that the zeros of FIR filter exists as reciprocals. (5)
- 6 Design a digital Butterworth filter that has -1dB pass band attenuation at 200 Hz and at least -15dB stop band attenuation at 540 Hz. Sampling frequency = 2000 Hz. Find the cut off frequency by matching pass band criterion. Use Bilinear transformation ($T = 1$ sec) (15)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Explain the steps through which we obtained direct form II realization of recursive LTI system described by difference equation. (10)

$$y(n) = -\sum_{k=1}^N a_k y(n-k) + \sum_{k=0}^M b_k x(n-k)$$

- b) Draw the architecture block diagram of TMS320C67XX processor (5)
- c) Obtain the transposed direct form II structure for the system (5)
- $$y(n) = 2y(n-1) + 3y(n-2) + x(n) + 2x(n-1) + 3x(n-2)$$
- 8 a) Find the impulse response $h(n)$ of a FIR filter, if the reflection coefficients are $K_1 = 2/5, K_2 = 4/21, K_3 = 1/8$. (6)
- b) What is transposition theorem and transposed structure? (6)
- c) Obtain direct form II and cascade structure for the transfer function given below. (8)

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}$$

- 9 a) Explain the effect of coefficient quantization in IIR and FIR filters? (10)
- b) What are the main features of DSP processor? (5)
- c) Explain the effect in the spectrum of a signal $x(n)$ when it is (5)
- (i) Decimated by a factor 3
- (ii) Interpolated by a factor 2
