

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh semester B.Tech examinations (S), September 2020

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 What is the necessity of computing Fast Fourier Transform? Calculate the number of multiplication needed in the calculation of DFT using FFT algorithm with 32 point sequence. (5)
- 2 Check whether the following transfer function is of linear phase. Justify your answer. $H(z) = \left(\frac{1}{2} + z^{-1} + \frac{1}{2}z^{-2}\right)\left(1 + \frac{1}{3}z^{-1} + z^{-2}\right)$ (5)
- 3 How s-plane is mapped to z-plane using impulse invariant transformation? Comment on the stability of the filter after this transformation. (5)
- 4 What do you mean by Gibbs phenomenon in connection with FIR filter design. How its effect can be reduced? (5)
- 5 Explain product quantization error and obtain the quantization noise model for a second order system. (5)
- 6 What is truncation? What is the error caused due to truncation of a number to b bits? (5)
- 7 What are the memory and I/O spaces used in TMS320C24x processor? (5)
- 8 Explain (i) Interrupt flag register (ii) Microstack (iii) Scaling shifters (5)

PART B*Answer any two full questions, each carries 10 marks.*

- 9 Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$, find $X(K)$ using DIF FFT algorithm. (10)
- 10 a) How will you compute linear convolution using DFTs? (5)
- b) Realize the following system function using minimum number of multipliers: (5)

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

(10)

- 11 Obtain the direct form II and cascade realization of

$$y(n] = x(n] + 2x(n - 1] + \frac{1}{2}y(n - 1] - \frac{1}{2}y(n - 2]$$

PART C

Answer any two full questions, each carries 10 marks.

- 12 (a) Find the order of an analog Butterworth filter that has a -2dB passband attenuation at a frequency of 20rad/sec and atleast -10dB stopband attenuation at 30rad/sec (5)
- (b) With the help of neat diagrams, explain frequency warping. How it can be eliminated? (5)
- 13 a) For the analog transfer function $H(s) = \frac{2}{(s+2)(s+3)}$, determine H(z) using bilinear transformation method for T=1 sec. (5)
- b) The desired frequency response of a lowpass filter is given below. (5)

$$H_d(\omega) = \begin{cases} e^{-j3\omega} & \text{for } -\frac{\pi}{4} \leq \omega \leq \frac{\pi}{4} \\ 0 & \text{for } \frac{\pi}{4} \leq |\omega| \leq \pi \end{cases}$$

. Obtain the filter coefficients h(n) by using a rectangular window.

- 14 Using frequency sampling method design an FIR lowpass filter with $\omega_c = \frac{\pi}{4}$ rad/sec for N=15. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 Find the effect of coefficient quantization on pole locations of the given IIR system when it is realised in cascade form. Assume a word length of 3 bits excluding sign bit. (10)

$$H(z) = \frac{1}{1 - 0.8z^{-1} + 0.15z^{-2}}$$

- 16 a) Check whether limit cycle exists for the following first order IIR filter with difference equation $y(n] = x(n] + Q[ay(n - 1)]$ if $a = -\frac{1}{3}$ and the input $x(n] = 0.875, n = 0$ and $x(n] = 0, n \neq 0$ and $y(-1] = 0$. The data register length is 4 bits including sign bit. Q[.] represents rounding operation. (5)
- b) How the instruction sets of TMS320C24x processor are classified? (5)
- 17 With a functional block diagram, explain the main architectural features of TMS320C24x processor. (10)
