Reg No.: Name:

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

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 State any five properties of DFT. (5) 2 Explain single stage lattice structure for an FIR filter with neat diagram and (5) equations. 3 (5) For the analog transfer function $H(s) = \frac{1}{(s+1)(s+2)}$, determine H(z) using impulse invariance method for T=1 sec. 4 What do you understand by linear phase response? Mention the characteristics of (5) linear phase FIR filter.

- 5 What is meant by product quantization error in digital signal processing? (5)
- 6 Define is zero input limit cycle oscillation with an example. (5)
- Define the function of (i) Program Counter (ii) Program Address Register (iii) (5) Stack and (iv) Microstack
- 8 How the instruction set of TMS 320C24x processor is classified? (5)

PART B

Answer any two full questions, each carries 10 marks.

- Calculate the 8-point DFT of x[n] using Decimation in Frequency FFT (10) Algorithm. $x[n] = \{0,1,2,3,4,5,6,7\}$
- 10 a) Perform the linear convolution of the following sequences using overlap-add method. $x(n) = \{1, -2, 2, -1, 3, -4, 4, -3\}$ and $h(n) = \{1, -1\}$
 - b) Determine the cascade form realization for the transfer function of an FIR digital (5) filter which is given by

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

Realize using direct 1 form, direct-2 form and cascade form representation of filter given by transfer function (10)

$$H(z) = \frac{8 - 4z^{-1} + 11z^{-2} - 2z^{-3}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}$$

PART C

Answer any two full questions, each carries 10 marks.

Using Bilinear transformation, design a Butterworth filter which uses a sampling (10) rate of 1 kHz, to satisfy following specifications

$$0.8 \le \left| H(e^{jw}) \right| \le 1 \text{ for } 0 \le \left| w \right| \le 0.2\pi$$

 $\left| H(e^{jw}) \right| \le 0.2 \text{ for } \left| w \right| \ge 0.6\pi$

- 13 a) Derive the equation for transformation of H(s) to H(z) using impulse invariance (5) method. Discuss about stability of the system after transformation.
 - b) Compare Rectangular and hanning window with the help of required equations. (5)
- Using frequency sampling method, design a band pass filter with following specifications. (10)

Sampling frequency f=10 kHz, Cut-off frequencies f_{c1} = 2000kHz and f_{c2} = 4000kHz . Take N=7.

PART D

Answer any two full questions, each carries 10 marks.

15 a) In the given IIR system, the products are rounded to 4 bits including sign bit. (7)

$$H(z) = \frac{1}{(1 - 0.35z^{-1})(1 - 0.62z^{-1})}$$

Find the output round off noise power in direct form realization.

- b) Compare the fixed point and floating point arithmetic. (3)
- 16 a) What are the methods used to prevent overflow in digital filter implementations? (5)
 - b) Defineany five I/O instructions used in TMS320C24x (5)
- What are the addressing modes in TMS 320C24x processor? Describe with (10) examples.
