Reg No.:_______________ Name:_______________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 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	State and prove complex conjugate property of Discrete Fourier Transform (DFT).	(5)
2	Draw the cascade structure of the FIR filter represented by the system function $H(z) = (1 + 2z^{-1})\left(1 + \frac{1}{2}z^{-1} + z^{-2}\right)$ Can you realize this system using minimum number of multipliers?	(5)
3	Convert the analog filter with system function $H(s) = \dfrac{s+0.1}{(s+0.1)^2+9}$ into a digital filter by means of the impulse invariance method. Sampling time T=1sec.	(5)
4	What is the advantage of windowing technique in FIR filter design? What are the desirable characteristics of a window used to truncate the infinite impulse response?	(5)
5	What are the common methods of quantization? Explain.	(5)
6	With suitable example explain floating point number representation	(5)
7	What are the functions of Auxiliary Register Arithmetic Unit (ARAU) of TMS320C24x DSP Controller?	(5)
8	With diagram explain the multiplication operation in TMS320C24x DSP Controller.	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	Find the 8 point DFT of the sequence x(n)={5,4,3,2,2,3,4,5} using Decimation in Time FFT algorithm.	(10)
10	a)	Explain circular time shift property of DFT. Let x(n)={1,2,3,4,5}. The five point DFT of x(n) is denoted as X(k). If $Y(k) = e^{\frac{-j6k\pi}{5}}X(k)$,find y(n).	(5)
	b)	With the help of diagram and equations explain the single stage all pole lattice IIR filter structure.	(5)
11	a)	Draw the FIR linear phase realization using minimum number of multipliers of the system function $H(z) = (1 + \frac{1}{2}z^{-1} + z^{-2})(1 + \frac{1}{4}z^{-1} + z^{-2})$	(4)

b) Determine and draw the parallel form realization of the IIR filter structure represented by the difference equation $y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.252x(n-2)$ (6)

PART C

Answer any two full questions, each carries 10 marks.

12 Design a digital Butterworth filter satisfying the constraints (10)

$$0.707 \le |H(e^{j\omega})| \le 1 \quad \text{for } 0 \le \omega \le \pi/2$$

$$|H(e^{j\omega})| \le 0.2 \quad \text{for } 3\pi/4 \le \omega \le \pi$$

with T=1s using Bilinear transformation

13 a) A digital low pass filter is required to meet the following specifications: Pass band ripple≤1dB, Pass band edge frequency:4kHz, Stop band attenuation≥40dB, Stop band edge frequency:6kHz and Sampling frequency :24kHz. Determine the order of a Chebyshev filter to meet the specifications in the digital implementation using bilinear transformation. (5)

b) With equations explain how impulse response of an FIR filter is obtained using frequency sampling method. (5)

14 a) Design an FIR high pass filter using hanning window with a cut off frequency of 1.2 rad/sec and length N=7. (10)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Consider the cascaded realisation of the following first order sections. $H_1(z) = \frac{1}{1-0.9z^{-1}}$ $H_2(z) = \frac{1}{1-0.8z^{-1}}$ Obtain the product quantisation model of the system and determine overall output noise power. (8)

b) Which are the methods used to prevent overflow? (2)

16 a) Explain limit cycle oscillations in digital filters. (5)

b) Explain the IO and Memory instructions in TMS320C24x DSP controller. (5)

17 a) Explain the central processing unit of TMS320C24x. (5)

b) Explain the three basic memory addressing modes used by the TMS320C24x instruction set. (5)

****