Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S, FE) Examination January 2023 (2015 Scheme)

JYOTHI ENGG. COLLEGE THRISSUR EDUCATIONAL TRUST CHERUTHURUTHY

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 the 4 point DFT of $x(n) = \sin\frac{n\pi}{2}$ (4)

b) Find linear convolution of x(n) = {1,2,3,1} and h(n) = {1,1,1}, using circular convolution (3)

c) Find the 8 point DFT of the sequence {1, 2, 3, 4, 4, 3, 2, 1} using DIF FFT algorithm (8)

2 a) Find the linear convolution of x(n)= {1,2,-1,2,3,-2,-3,-1,1,1,2,-1} and h(n) = {1,2} using overlap save method. (9)

b) Find the IDFT of X(k) = {1, -0.33j , 0.33, 0.33j} using DIT FFT algorithm. (6)

3 a) Find 8 point DFT of the sequence x(n)= {1,2,2,2,0,1,1,1} using 4 point DFT (8)

b) State any four properties of DFT. (4)

c) Find the circular convolution of x(n)= {1, 1, 2, 1} and h(n) = {1, 2, 3, 4} (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a filter with (9)

$$H_d(\omega) = \begin{cases} e^{-3j\omega} & ; \quad |\omega| \le \frac{\pi}{4} \\ 0 & ; \quad otherwise \end{cases}$$

Using hamming window with N=7

b) An analog filter has a transfer function $H(s) = \frac{10}{s^2+7s+10}$. Design a digital filter equivalent to this using impulse invariant method. Assume T=0.2 sec (6)

5 a) Design an digital Butterworth filter for the given specification (10)

$$0.8 \le |H_d(e^{j\omega})| \le 1 \qquad for \quad 0 \le \omega \le 0.2\pi$$

$$|H_d(e^{j\omega})| \le 0.2 \qquad for \quad 0.6\pi \le \omega \le \pi$$

b) Explain the procedure for designing FIR filters using windows. (5)

6 a) Design a linear phase FIR filter with (9)

$$H_d(e^{j\omega}) = \begin{cases} e^{-\alpha j\omega} & ; \quad 0 \le |\omega| \le 0.55\pi \\ 0 & ; \quad otherwise \end{cases}$$

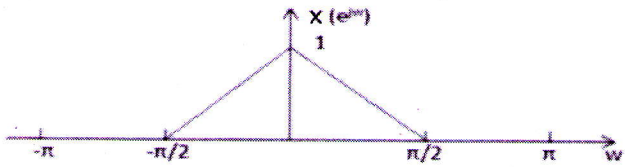
Using frequency sampling technique with N=7.

b) Design an analog Butterworth filter that has –2 dB pass band attenuation at frequency of 20 rad/sec & -10dB stop band attenuation at 30 rad/sec. (6)

PART C

Answer any two full questions, each carries 20 marks.

7 a) The frequency response of input is shown in figure. Sketch the frequency response of the output of downsampler (M=2). (5)



b) What is an anti-imaging filter? What is its need? (5)

c) With the help of a block diagram explain the architecture of TMS320C67xx digital signal processor. (10)

8 a) Draw the parallel form realization of (5)

$$H(z) = \frac{0.7 - 0.252z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}}$$

b) Obtain the cascade realization of linear phase FIR having system function (5)

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

Using minimum number of multipliers.

c) Explain finite word length effects in FIR and IIR digital filters. (10)

9 a) Determine the lattice form structure of the FIR filter of difference equation (10)

$$y(n) = 2x(n) + \frac{4}{5}x(n-1) + \frac{3}{2}x(n-2) + \frac{2}{3}x(n-3)$$

b) Derive the expression for the variance of quantization noise in ADC with step size Δ. Assume quantization noise has uniform distributed pdf with zero mean. (5)

c) Explain interpolation and decimation (5)

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