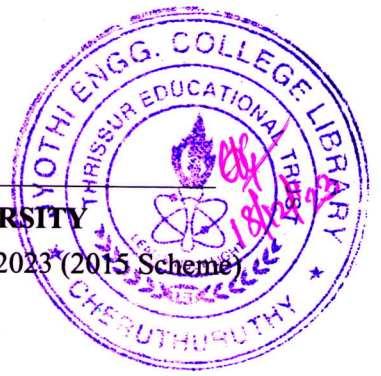


Reg No.: _____

Name: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S5 (PT) (S, FE) Examination December 2023* (2015 Scheme)



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 IDFT of $X(k) = \{1,0,1,0\}$ (3)
- b) Find the linear convolution of $x(n) = \{1, 2, 1, 2, 1, 2, 1, 2, 1, 2, 1\}$ and $h(n) = \{1,3,1\}$ using overlap save method. (8)
- c) State and prove Parseval's theorem. (4)
- 2 a) Compute 8 point DFT using DIT FFT for the sequence $x(n) = 2^n ; 0 \leq n \leq 7$ (8)
- b) Find 4 point DFT of the sequences $x_1(n) = \{4,3,1,5\}$ and $x_2(n) = \{6,-4,2, 5\}$ using single DFT. (7)
- 3 a) Find 8 point DFT of the sequence $x(n) = \{0,1,2,3,4,5,6,7\}$ using radix-2 DIF-FFT algorithm. (8)
- b) Find the linear convolution of $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$ and $h(n) = \{1, 1, 1\}$ using overlap add method. (7)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Design a band pass filter to pass frequencies in the range 1 to 2 rad/sec using Hanning window with $N=5$ (7)
- b) Explain the procedure for designing FIR filters using frequency sampling method.* (5)
- c) Write any three comparisons between the design methods used for Linear Phase FIR Filters (3)
- 5 a) Design an analog Butterworth filter for the given specification (6)

$$0.9 \leq |H(j\Omega)| \leq 1 \quad \text{for } 0 \leq \Omega \leq 0.2\pi$$

$$|H(j\Omega)| \leq 0.2 \quad \text{for } 0.4\pi \leq \Omega \leq \pi$$

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- b) Design a Butterworth low pass digital IIR filter with a pass band edge frequency of 0.25π with a ripple not exceeding 0.5dB and a minimum stop band attenuation 15dB with a stop band edge frequency of 0.55π . Use bilinear transformation. (9)
- 6 a) An analog filter has a transfer function $H_a(s) = \frac{(s+0.1)}{(s+0.1)^2+9}$. Design a digital filter (7)
equivalent to this using impulse invariant method. Assume $T=1$ sec
- b) The desired frequency response of a LPF is (8)

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

Determine filter coefficients for $N=7$ using hamming window.

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Obtain the direct form I, direct form II, cascade and parallel form realization for (20)
the system with transfer function

$$H(z) = \frac{3 + 3.6z^{-1} + 0.6z^{-2}}{1 + 0.1z^{-1} - 0.2z^{-2}}$$

- 8 a) Obtain the expression for the output $y(n)$ when an input sequence $x(n)$ is first applied (5)
to an interpolator with upsampling factor $L=5$, then to a decimator with a
downsampling factor $M=10$ and again upsampled by a factor $L=2$.
- b) Explain finite word length effects in IIR digital filter (10)
- c) Differentiate fixed point and floating point arithmetic. (5)
- 9 a) Draw the architectural block diagram of TMS320C67XX DSP processor and (10)
explain each block.
- b) Explain the effect in the spectrum of a signal $x(n)$ when it is (5)
(i) Decimated by a factor 2
(ii) Interpolated by a factor 2
- c) Explain round off errors (5)
