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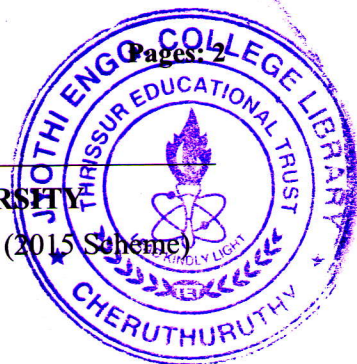
Pages: 2

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (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) Write down the equation for N point DFT and explain each term (4)
- b) Find N point DFT of unit impulse $\delta(n)$ (4)
- c) Find 4 point DFT of $x(n) = [1, -2, 3, 2]$. (7)
- 2 a) Find 4 point circular convolution of $x(n) = h(n) = [1, 1, 1, 1]$ using DFT. (8)
- b) Compute 8-point DFT of the sequence $[1, 1, 1, 1, 0, 0, 0, 0]$ using Decimation in Time FFT algorithm (7)
- 3 a) Let $x(n) = \{1, 0, 1, 0\}$ and $h(n) = \{1, 2, 2, 1\}$. Find 4 point DFTs of these sequences using a single 4 point DFT. (8)
- b) Find the IDFT of $X(k) = [1, 0, 1, 0]$ using DIF FFT algorithm. (7)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Prove that a symmetric impulse response results in a linear phase response for an FIR filter with an even filter order N. (8)
- b) Compare main 3 properties of rectangular, Hanning and Hamming window functions. (3)
- c) How filter order is selected in the window-based method of FIR filter design. (4)
- 5 a) Explain impulse invariant mapping. List the main limitations of impulse invariant mapping. (5)
- b) Design a Digital Butterworth filter to satisfy the constraints $0.9 \leq |H(\omega)| \leq 1$; $0 \leq \omega \leq 0.5\pi$. $|H(\omega)| \leq 0.2$; $0.75\pi \leq \omega \leq \pi$. Use bilinear transformation. Assume $T=1$ s. (10)
- 6 a) Design a Linear phase LPF with a cut off frequency of 0.5π rad/s using frequency sampling. Take $N = 13$, use type 1 design. (10)
- b) Derive the mapping function from s to z in Bilinear transformation. Explain frequency warping. (5)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Realise the system given by $H(z) = \frac{3+3.6z^{-1}+0.6z^{-2}}{1+0.1z^{-1}-0.2z^{-2}}$ in cascade form and parallel form. (10)
- b) Explain transposed form of filter structure. Realise the system $y(n) = b_0x(n) + b_1x(n-1) + b_2x(n-2) - a_1y(n-1) - a_2y(n-2)$ in transposed form. (10)
- 8 a) Explain decimation and interpolation. (6)
- b) Explain effects of coefficient quantisation in FIR and IIR filters. (7)
- c) Why lowpass filtering is performed before down sampling? How will you decide the cutoff frequency of the low pass filter? (7)
- 9 a) Explain the architecture of TMS320C67XX DSP processor with a neat diagram. (10)
- b) Realise the transfer function $H(z) = \frac{1+2z^{-1}}{1-1.5z^{-1}+0.9z^{-2}}$ in Direct form 1 and 2. (10)
- Compare the number of delay elements, adders and multipliers needed in both cases.
