

Code No: 156AR

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, February/March - 2022

DIGITAL SIGNAL PROCESSING

(Common to ECE, EIE)

Time: 3 Hours

Max. Marks: 75

**Answer any five questions
All questions carry equal marks**

- 1.a) What are the conditions for stability and causality of an LTI system? Explain.
- b) Explain in detail the classification of discrete-time systems.
- c) What is the need for multi-stage implementation of sampling rate converters? Explain with an example. [5+5+5]

- 2.a) Find 8-point DFT $X(K)$ of the real sequence.
 $x(n) = \{0.707, 1, 0.707, 0, -0.707, -1, -0.707, 0\}$ by using DIF radix-2 FFT
- b) Find the N-point DFT of $x(n) = b^n \cos an$ using the linearity property. [8+7]

- 3.a) State and prove any two properties of Discrete Fourier series.
- b) Given $x(n) = 2^n$ and $N=8$, find $X(k)$ using DIT-FFT algorithm. [6+9]

- 4.a) Design a digital low pass filter using Chebyshev filter that meets the following specifications: Passband magnitude characteristics that is constant to within 1dB for frequencies below $\omega = 0.2\pi$ and stopband attenuation of atleast 15dB for frequencies between $\omega = 0.3\pi$ and π . Use bilinear transformation.
- b) Derive the relation between digital and analog frequencies in bilinear transformation. [10+5]

- 5.a) Design a Butterworth analog high pass filter that will meet the following specifications
i) Maximum pass band attenuation = 2dB
ii) Passband edge frequency = 200rad/sec
iii) Minimum stopband attenuation = 20dB
iv) Stop band edge frequency = 100 rad/sec.
- b) Prove that for a linear phase FIR filter the impulse response is symmetric. [8+7]

- 6.a) Explain the type II frequency sampling method of designing an FIR digital filter.
- b) Design a band pass filter which approximates the ideal filter with cutoff-frequencies at 0.2rad/sec and 0.3rad/sec. The filter order is $M=7$. Use the Hanning window function. [5+10]

- 7.a) Explain coefficient quantization of IIR filters.
- b) What is Round-off Noise in IIR Digital Filters? Discuss its effects in IIR filters. [7+8]

- 8.a) Describe various Structures of IIR filters with suitable diagrams.
- b) Explain the limit cycle oscillations due to product round-off and overflow errors. [10+5]

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