

Code No: 156AR

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

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- 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 at least 15dB for frequencies between  $\omega = 0.3\pi$  and  $\pi$ . 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]