

R15

Code No: 127CK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech IV Year I Semester Examinations, July/August - 2023

DIGITAL SIGNAL PROCESSING
(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) Determine the stability and causality of the system with $h[n] = \left(\frac{1}{3}\right)^n u(n)$. [2]
- b) Write any three applications of z-transforms. [3]
- c) State Time shifting property of DFT? [2]
- d) Differentiate between DIT FFT and DIF FFT. [3]
- e) Give direct-form I structure of second order system realization. [2]
- f) Realize $y[n] + y[n + 1] + \frac{1}{4}y[n - 2] = x[n]$ in cascade form network. [3]
- g) Define Hamming window. [2]
- h) What is the necessary and sufficient condition for linear phase characteristic in FIR filter? [3]
- i) Define up sampling and down sampling with an example. [2]
- j) What is Dead-band of a filter? [3]

PART – B

(50 Marks)

- 2.a) Check the following system described with difference equations for linearity, shift invariance, memory and causality; $y[n] - y[n - 1] = x[n]$.
- b) Determine the impulse response for the cascade of two LTI systems having impulse responses $h_1[n] = \left(\frac{1}{2}\right)^n u[n]$ and $h_2[n] = \left(\frac{1}{4}\right)^n u[n]$. [5+5]

OR

3. Obtain the direct form I, direct form II, cascade and parallel form realization for the system:
 $y(n) = -0.1 y(n - 1) + 0.2 y(n - 2) + 3 x(n) + 3.6 x(n - 1) + 0.6 x(n - 2)$. [10]

- 4.a) Compute the 4-point Circular Convolution of the sequences $x_1[n] = \{2, 1, 2, 7\}$ and $x_2[n] = \{1, 2, 3, 4\}$ by using DFT and IDFT method.
- b) Establish the relation between DFT and z-transform. [5+5]

OR

5. Compute the eight-point DFT of the sequence by using DIF FFT algorithm and draw its radix-2 flow graph.

$$x(n) = \begin{cases} 1, & 0 \leq n \leq 7 \\ 0, & \text{otherwise} \end{cases} \quad [10]$$

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6. Using the bilinear transform, design a high pass filter, monotonic in pass band with cut off frequency of 1000 Hz and down 10dB at 350 Hz. The sampling frequency is 5000 Hz.[10]

OR

- 7.a) Explain the procedure for designing Analog filters using the Chebyshev approximation.

- b) Write a short note on spectral transformations. [5+5]

QA

8. Design an ideal differentiator with frequency response using rectangular window with $N = 8$. Plot the frequency response.

$$H(e^{j\omega}) = j\omega - \pi \leq \omega \leq \pi \quad [10]$$

OR

- 9.a) Discuss frequency sampling method for an FIR filter design.

- b) Compare IIR and FIR in detail. [5+5]

QA

- 10.a) Define sampling rate conversion. Explain the process of Interpolation by a factor L .

- b) Write the applications of Multirate signal processing. [5+5]

OR

- 11.a) Write a short notes on Round-off Noise in IIR Digital Filters

- b) Explain about the methods to prevent Overflow. [5+5]

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