Code No: 127CK **R15**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech IV Year I Semester Examinations, January/February - 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 $h[n] = (\frac{1}{2})^n u(n)$. | [2] |
| b) | Explain the frequency representation of discrete time systems. | [3] |
| c) | Write any two properties of DFS. | [2] |
| d) | Differentiate between Decimation-in-time and Decimation-in-frequency. | [3] |
| e) | Draw the parallel form structure of IIR filter. | [2] |
| f) | What is Prewarping? | [3] |
| g) | Give the equations for Hamming window and Blackmann window. | [2] |
| h) | Distinguish between FIR and IIR filters. | [3] |
| i) | What is the need for anti-aliasing filter prior to down sampling? | [2] |
| j) | What is Dead-band of a filter? | [3] |

## PART – B

**(50 Marks)**

2. Determine the response $y(n), n \geq 0$, of the system described by the second-order difference equation $y(n) - 3\,y(n-1) - 4\,y(n-2) = x(n) + 2x(n-1)$ when the input sequence is $x(n) = 4^n\,u(n)$. [10]

**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) State and prove any two properties of DFT.
b) Establish the relation between DFT and z-transform? [5+5]

**OR**

5. Draw and calculate 8-point DITFET flow graph for the DFT sequence of x[n] = {1,1,1,1,1,1,1,1} by using radix-2. [10]

6. Using Bilinear transformation, design a high pass filter, monotonic in pass band with cutoff frequency of 1000 Hz and down 10dB at 350 Hz. The sampling frequency is 5000 Hz. [10]

**OR**

7. Explain the procedure for designing Analog filters using the Chebyshev approximation. [10]

8. Design an FIR linear-phase, digital filter approximating the ideal frequency response

$$H_d(\omega) = \begin{cases} 1 & \text{for } |\omega| \leq \pi/6 \\ 0 & \text{for } \pi/6 < |\omega| \leq \pi \end{cases}$$

using a Hamming window. [10]

**OR**

9. Design a FIR digital low-pass filter with a cutoff frequency of 1 kHz and a sampling rate of 4 kHz with 7 samples using Fourier series method. [10]

10. Explain about sampling rate conversion by a rational factor I/D. [10]

**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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