Enrolment No./Seat No_____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII EXAMINATION – SUMMER 2025**

**Subject Code:3171708 Date:19-05-2025**

**Subject Name:Digital Signal Processing (IC)**

**Time:02:30 PM TO 05:00 PM Total Marks:70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | Check whether the system Y(n) = a x(n) + b is<br>1. Static –Dynamic<br>2. Linear – Non linear<br>3. Time invariant – Time variant | **03** |
| | **(b)** | Write a short note on frequency domain sampling and reconstruction of discrete – time signals. | **04** |
| | **(c)** | What are the basic elements of Digital Signal Processing of the system? State advantages of Digital over analog signal processing. | **07** |
| **Q.2** | **(a)** | Explain with suitable example recursive and non-recursive system. | **03** |
| | **(b)** | Perform the circular convolution of the two sequences x1(n)={2,1,2,1} and x2(n)={1,2,3,4}. | **04** |
| | **(c)** | Represent the system transfer function $H(z)=(1-\frac{2}{7}z^{-1}+\frac{3}{8}z^{-2}+\frac{7}{8}z^{-3})(1-\frac{4}{9}z^{-1}-\frac{1}{2}z^{-2}-\frac{5}{2}z^{-3})$ using cascade form structure. | **07** |
| | | **OR** | |
| | **(c)** | Determine the direct form I , form II and cascade realization for following system.<br>Y(n)=x(n) - x(n-1) + 2 x (n-2) -3 y(n-1)+4y(n-2) | **07** |
| **Q.3** | **(a)** | List basic structures of IIR systems and explain any one in brief. | **03** |
| | **(b)** | Brief about overlap-add method for filtering of long data sequences. | **04** |
| | **(c)** | Explain radix 4 FFT Algorithms. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Prove the Properties of DTFT. | **03** |
| | **(b)** | Compute 4 point DFT of the given sequence x[n]= {1,2,3,4} | **04** |
| | **(c)** | Draw 4 point DIF-FFT butterfly diagram. | **07** |
| **Q.4** | **(a)** | Derive the lattice structures of FIR filters. | **03** |
| | **(b)** | Discuss about Decimation in Frequency algorithm of FFT. | **04** |
| | **(c)** | Explain symmetry properties of DFT. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | With example explain signal flow diagram representations of Linear Constant-Coefficient Difference equations. | **03** |
| | **(b)** | Enlist difference between FIR and IIR Filter. | **04** |

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|---|---|---|---|
| | **(c)** | Explain in brief about impulse invariance method for IIR filter design. | **07** |
| **Q.5** | **(a)** | What are the limitations of filter design by approximation of derivatives? | **03** |
| | **(b)** | Give difference between radix-2 and radix-4 FFT algorithm | **04** |
| | **(c)** | Explain Radix-2 Decimation in Time algorithm. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | What is signal? List and explain any three type of signals. | **03** |
| | **(b)** | Explain Hanning window technique for filter design. | **04** |
| | **(c)** | List methods for filtering of long data sequence. Explain any one in detail. | **07** |

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