Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022
Subject Code:3171708   **Date:01/06/2022**
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.**

Q.1 **(a)** What are the advantages of designing filter using digital signal processing?   **03**
         (b) Write a short note on frequency domain sampling and reconstruction of   **04**
                  discrete – time signals.
         (c) Write about block diagram and signal flow diagram representations of Linear   **07**
                  Constant-Coefficient Difference Equations.

Q.2 **(a)** Explain effects of Co-efficient quantization and discuss how to minimize it.   **03**

         (b) With suitable example explain transposed form structure of discrete time   **04**
                  system.

         (c) Represent   the   system   transfer   function   **07**
                  $H(z) = (1 - \frac{1}{7}z^{-1} + \frac{5}{8}z^{-2} + \frac{7}{8}z^{-3})(1 - \frac{7}{9}z^{-1} - \frac{5}{2}z^{-2} - \frac{3}{2}z^{-3})$ using direct form -II

                  structure.
                  OR
         (c) Represent   the   system   transfer   function   **07**
                  $H(z) = (1 - \frac{2}{7}z^{-1} + \frac{3}{8}z^{-2} + \frac{7}{8}z^{-3})(1 - \frac{4}{9}z^{-1} - \frac{1}{2}z^{-2} - \frac{5}{2}z^{-3})$ using cascade form

                  structure.

Q.3 **(a)** List basic structures of IIR systems and explain any one in brief.   **03**
         (b) Explain any four properties of Discrete Fourier Transform.   **04**
         (c) Compute 4 point DFT of sequence $x(n) = \{1, 2, 3, 4\}$ using definition of DFT.   **07**

                  OR
Q.3 **(a)** Write advantages of the FFT algorithm.   **03**
         (b) Brief about overlap-add method for filtering of long data sequences.   **04**
         (c) Determine IDFT of $x(k) = \{2, 1 + j, 0, 1 - j\}$ using definition.   **07**

Q.4 **(a)** With reason explain prewarping procedure during filter design.   **03**
         (b) Discuss about Decimation in Frequency algorithm of FFT.   **04**
         (c) Using DIT FFT radix-2 algorithm find transform of $x(n) = \{1, 2, 3, 5, 5, 3, 2, 1\}$ **07**
                  OR
Q.4 **(a)** Give difference between radix-2 and radix-4 FFT algorithm.   **03**
         (b) Write about Bilinear Z-Transform method of IIR filter design.   **04**
         (c) Perform circular convolution for following two sequences   **07**
                  $x_1(n) = \{\underset{\uparrow}{2}, 0, 0, 1\}$ and $x_2(n) = \{\underset{\uparrow}{4}, 3, 2, 1\}$

Q.5 **(a)** What are the limitations of filter design by approximation of derivatives? **03**
(b) Explain Bartlett window technique for filter design. **04**
(c) With suitable example write a note on linear filtering using DFT. **07**

OR

Q.5 **(a)** Briefly compare FIR and IIR filter characteristics. **03**
(b) Explain Hanning window technique for filter design. **04**
(c) Analog filter is given as $X(s) = \dfrac{s+0.1}{(s+0.1)^2 + 25}$, using proper steps design digital filter with impulse invariance method. **07**

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