

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-VII (NEW) EXAMINATION – SUMMER 2022**

Subject Code: 2171003

Date: 14/06/2022

Subject Name: Digital Signal Processing

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.

|            |                                                                                                                                                                     | <b>MARKS</b> |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Q.1</b> | (a) Determine the Nyquist sampling frequency and Nyquist interval for the signal, $x(t) = \left[ \frac{\sin 200\pi t}{\pi t} \right]^2$ .                           | <b>03</b>    |
|            | (b) Compare the direct form and linear phase structures of an $N^{\text{th}}$ order FIR system.                                                                     | <b>04</b>    |
|            | (c) What is Digital Signal Processing? List the unique architectural features of DSP processors.                                                                    | <b>07</b>    |
| <b>Q.2</b> | (a) In an LTI system the impulse response $h(n) = C^n$ for $n \leq 0$ . Determine the range of values of $C$ , for which the system is stable.                      | <b>03</b>    |
|            | (b) List the properties of Butterworth lowpass filters.                                                                                                             | <b>04</b>    |
|            | (c) Using $z$ -transform, perform deconvolution of response $y(n) = \{-2, 5, -5, 2, 1\}$ and impulse response $h(n) = \{1, -1, 1\}$ , to extract the input $x(n)$ . | <b>07</b>    |
|            | <b>OR</b>                                                                                                                                                           |              |
|            | (c) Explain the decimation and interpolation process with an example.                                                                                               | <b>07</b>    |
| <b>Q.3</b> | (a) Find the $z$ -transform of $e^{-\alpha n} u(n)$ .                                                                                                               | <b>03</b>    |
|            | (b) Determine the regions of convergence of right-sided, left-sided, infinite-duration two-sided and finite-duration two-sided sequences.                           | <b>04</b>    |
|            | (c) Determine the impulse response $h(n)$ for the system described by the second order difference equation,<br>$y(n) - 4y(n-1) + 4y(n-2) = x(n-1)$ .                | <b>07</b>    |
|            | <b>OR</b>                                                                                                                                                           |              |
| <b>Q.3</b> | (a) List the application of an adaptive filter. Briefly explain any one of it.                                                                                      | <b>03</b>    |
|            | (b) What do you mean by frequency wrapping?                                                                                                                         | <b>04</b>    |
|            | (c) Discuss design steps of IIR filter using bilinear transformation.                                                                                               | <b>07</b>    |
| <b>Q.4</b> | (a) What are the factors that influence the choice of structure for realization of an LTI system?                                                                   | <b>03</b>    |
|            | (b) Find the Fourier transform of,<br>$x(n) = -a^n u(-n-1)$ , where $ a  < 1$ .                                                                                     | <b>04</b>    |
|            | (c) Discuss in brief: Radix-2 Decimation-in-Time FFT algorithms.                                                                                                    | <b>07</b>    |
|            | <b>OR</b>                                                                                                                                                           |              |
| <b>Q.4</b> | (a) What is Gibbs phenomenon?                                                                                                                                       | <b>03</b>    |

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**Marco Cascella**



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