

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER- V EXAMINATION – SUMMER 2026****Subject Code:3150912****Date:09-06-2026****Subject Name:Signals and Systems****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

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| Q.1 | (a) Define a periodic continuous time and discrete time signal with a mathematical equation. | 03 |
| | (b) Write an equation for continuous time energy signal & power signal. Prove following.
(i) The power of the energy signal is zero over infinite time.
(ii) The energy of the power signal is infinite over infinite time | 04 |
| | (c) Define even and odd components of signal $x(t)=\cos(\omega_0 t + \frac{\pi}{3})$ and show that $x(t)$ is the composition of its even and odd component. | 07 |
| Q.2 | (a) What is convolution? Write the convolution integral and sum formulae. | 03 |
| | (b) Sketch the following signals.
(i) $u(t+4) u(-t+4)$
(ii) $r(-t) u(t+2)$ | 04 |
| | (c) Prove the following system $y(n)$ is dynamic, causal, non-linear and time-invariant. $y(n) = x(n) x(n-6)$. | 07 |
| | OR | |
| | (c) Define stable and unstable systems. The system given below equation $h(t)$ is stable or unstable. $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$. | 07 |
| Q.3 | (a) Write the conditions under which any periodic waveform is expressed using Fourier series. | 03 |
| | (b) Find the Fourier transform of $x(t) = te^{-at}u(t)$. | 04 |
| | (c) State and prove time shifting and frequency shifting properties of Fourier transform. | 07 |
| | OR | |
| Q.3 | (a) State advantages and limitations of Laplace transforms. | 03 |
| | (b) Find Z – transform of $y(n) = x(n-1) u(n)$. | 04 |
| | (c) State and prove linearity and time-scaling properties of Laplace transform. | 07 |
| Q.4 | (a) Find the Z-transform of the unit step sequence $u(n)$. | 03 |
| | (b) Find Laplace transform and its ROC for $x(t) = t u(t)$. | 04 |
| | (c) What is aliasing? When does it occur and how can it be avoided? | 07 |

OR

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| Q.4 | (a) | Write an equation of the exponential Fourier series with its coefficients. | 03 |
| | (b) | Perform convolution of $x(t) = t u(t)$; $h(t) = t u(t)$ | 04 |
| | (c) | Explain the Zero-order hold and First-order hold methods to reconstruct the signals. | 07 |
| Q.5 | (a) | Write the properties of the Impulse function. | 03 |
| | (b) | Explain the different types of Actuators. | 04 |
| | (c) | What are the different types of sensors commonly used in IoT applications? | 07 |

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| Q.5 | (a) | Define Z-transform. What is the condition for Z-transform to exist? | 03 |
| | (b) | What are the effects of under-sampling of a signal? | 04 |
| | (c) | Describe how an Arduino-based system operates with a suitable example. | 07 |
