

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: 3144103

Date: 30/05/2026

Subject Name: Automatic Control System

Time: 10:30 AM TO 01:00 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)** Explain the role of controlled and manipulated variables in maintaining system performance. **03**
 - (b)** Compare open-loop and closed-loop control systems based on accuracy, stability and reliability. **04**
 - (c)** Illustrate a basic control system using block diagram and explain how each element contributes to system operation. **07**
- Q.2**
- (a)** Explain the importance of modelling in control system analysis. **03**
 - (b)** Compare force–voltage and force–current analogies in system representation. **04**
 - (c)** Explain signal flow graph representation and discuss how Mason’s Gain Formula helps in determining system behavior. **07**
- OR**
- Q.2**
- (c)** Explain modelling of a physical system and describe how block diagram representation simplifies system analysis. **07**
- Q.3**
- (a)** Explain why standard test signals are used in control systems. **03**
 - (b)** Discuss steady state error and its relationship with system type. **04**
 - (c)** Explain transient response characteristics of second-order systems and analyze the influence of damping ratio. **07**
- OR**
- Q.3**
- (a)** Describe basic control actions used in control systems. **03**
 - (b)** Compare proportional and integral control actions in terms of performance. **04**
 - (c)** Evaluate different controllers based on their effect on system response and stability. **07**

- Q.4** (a) Explain the necessity of frequency response analysis in control systems. **03**
- (b) Describe the construction and interpretation of Bode plots. **04**
- (c) Explain Routh-Hurwitz stability criterion and discuss its practical limitations. **07**

OR

- Q.4** (a) Explain different types of system stability with examples. **03**
- (b) Discuss Nyquist stability criterion and its advantages. **04**
- (c) Explain root locus technique and analyze how system poles change with gain variation. **07**

- Q.5** (a) Explain the concept of state variables and their physical interpretation. **03**
- (b) Compare state space representation with transfer function approach. **04**
- (c) Explain formulation of state space model and discuss its advantages in modern control systems. **07**

OR

- Q.5** (a) Define state vector and state equation. **03**
- (b) Explain structure of state and output equations. **04**
- (c) Describe procedure for converting a differential equation into state space form and explain its significance. **07**
