

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 8 – EXAMINATION – SUMMER 2026

Subject Code: 2181705

Date: 19/05/2026

Subject Name: Advance Control Theory

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 Discretization of continuous time state space equation. **03**
 - (b) Obtain the z-transform of Unit -Step function. **04**
 - (c) Define and explain Zero order hold. **07**
- Q.2**
- (a) Derive the relationship between z and s-domain. Also explain the mapping of s-domain in to z-domain. **03**
 - (b) Explain the Stability criterion by the Jury test. **04**
 - (c) Describe the design of state feedback controller & state observer , with suitable example, in Discrete Domain **07**
- OR**
- (c) Describe the digital implementation of PID controller. **07**
- Q.3**
- (a) Introduce the terms positive definite, negative definite and indefinite function. **03**
 - (b) Explain Singular points in detail and discuss its various types with diagram/formula. **04**
 - (c) Derive describing function for a relay with dead zone with formula/calculation. **07**
- OR**
- Q.3**
- (a) Write a note on Lyapunov's direct method for stability analysis. **03**
 - (b) Explain jump resonance in non-linear system. **04**
 - (c) Define local stability, asymptotically stable, asymptotically stable at large and limit cycles for nonlinear system. **07**
- Q.4**
- (a) Write a short note on fuzzification process with example **03**
 - (b) What are fuzzy membership function and its types. **04**
 - (c) What is nonlinear system? Classify various types of nonlinearities **07**
- OR**
- Q.4**
- (a) Write a short note on defuzzification process with example **03**
 - (b) What is fuzzy logic control system? Explain application of fuzzy logic control system. **04**
 - (c) Explain phase plane method & construction of phase trajectories with suitable example. **07**
- Q.5**
- (a) What is multivariable system? Draw and explain the block diagram of multivariable system with example. **03**

(b) Explain decoupling of multivariable system and its stability. **04**

(c) What is two degree of freedom control? Explain the different types of method. **07**

OR

Q.5 **(a)** What is interacting and non-interacting systems? **03**

(b) List the methods of inverse Z-transform and explain with example. **04**

(c) Explain relative gain array for multivariable system. **07**
