

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-VII EXAMINATION – WINTER 2025****Subject Code:3172007****Date:20-11-2025****Subject Name:Modern Control Systems****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.

		Marks
Q.1	(a) State advantages of Modern control systems.	03
	(b) Explain performance measures for control systems.	04
	(c) With a suitable example Explain the Design of the Time and frequency domain compensator.	07
Q.2	(a) Define the terms: (i) state (ii) state variable (iii) state space.	03
	(b) Explain State transition Matrix.	04
	(c) Check controllability and observability for the system described by :	07
	$\dot{x} = \begin{bmatrix} 0 & 6 & -5 \\ 1 & 0 & 2 \\ 3 & 2 & 4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix} U$ $y = [1 \quad 2 \quad 3] x$	
	OR	
	(c) Determine the matrix exponential, and hence the state transition matrix, and the homogeneous response to the initial conditions $x_1(0) = 2$, $x_2(0) = 3$ of the system with state equations:	07
	$\dot{x}_1 = -2x_1 + u$ $\dot{x}_2 = x_1 - x_2$	
Q.3	(a) Explain Friction non linearities.	03
	(b) Explain term Asymptotic stability.	04
	(c) Explain Describing Function Analysis of Nonlinear control Systems.	07
	OR	
Q.3	(a) Explain backlash non linearities.	03
	(b) Explain term Exponential stability.	04
	(c) Explain phase plane and phase plane trajectory methods for Nonlinear control Systems.	07
Q.4	(a) What is the difference between analog and digital input controller?	03
	(b) Explain Z transform with Region of convergence.	04
	(c) Explain with a suitable example differential equation solution using the Z transform method.	07
	OR	
Q.4	(a) Explain the pulse transfer function.	03
	(b) Explain Stability analysis in the Z plane.	04
	(c) Explain with a suitable example inverse Z transform using infinite serial and partial fraction methods.	07

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| Q.5 | (a) | Differentiate feed-forward and feedback adaptive control methods. | 03 |
| | (b) | Draw and explain the Schematic diagram of Model Reference Adaptive Control. | 04 |
| | (c) | Explain reinforcement learning control. | 07 |
| | | OR | |
| Q.5 | (a) | What is an example of a fuzzy logic control system? | 03 |
| | (b) | Explain direct and indirect methods for neural control systems. | 04 |
| | (c) | Draw and explain the block diagram of Embedded Control system. | 07 |
