

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV EXAMINATION – WINTER 2025****Subject Code:3142407****Date:01-12-2025****Subject Name:Control Theory****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
Q.1	(a) Explain the principle of superposition for the control system.	03
	(b) What is laplace transform? Explain the advantages of laplace transform.	04
	(c) Draw a neat block diagram of a general closed loop control system. Explain the role of each of these block in detail.	07
Q.2	(a) Give the advantages of transfer function.	03
	(b) Give the difference between open loop and close loop system.	04
	(c) Draw a schematic diagram of armature controlled DC motor and its block diagram with closed loop. Derive the transfer function for armature controlled DC motor.	07
	OR	
	(c) Explain Type-0, Type-1 and Type-2 control system. Derive equation for the steady state error of the type-2 control system for step, ramp and parabolic input.	07
Q.3	(a) Explain first order system with example.	03
	(b) Define the terms of Signal Flow Graph: source node, sink node, non-touching loop and forward path.	04
	(c) Write a note on state variable approach verses the classical approach of transfer function for the analysis of control systems.	07
	OR	
Q.3	(a) Write a note on state variable approach verses the classical approach of transfer function for the analysis of control systems.	03
	(b) Explain the shifting of summing point and take off point in a control system for block diagram.	04
	(c) Write a brief note on frequency response.	07
Q.4	(a) Define: Rise Time, Settling Time And Fall Time.	03
	(b) Check the stability of the given characteristic equation using Routh's method. $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$	04
	(c) Derive necessary equation and Draw diagram for step response of a second order control system.	07
	OR	
Q.4	(a) Define: Phase margin and Gain margin.	03
	(b) Discuss in brief the concept of linearity of any control system in general.	04
	(c) Explain in detail the steps to design a lead compensator.	07

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| Q.5 | (a) | Briefly explain polar plots and its significance | 03 |
| | (b) | Explain bode plot of Lag-Lead compensator. | 04 |
| | (c) | Explain rules for construction of Root locus. | 07 |
| OR | | | |
| Q.5 | (a) | Explain standard test signals used in the control system. | 03 |
| | (b) | State and explain nyquist stability criterion. | 04 |
| | (c) | Write short note on PID controller. | 07 |
