

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:3142003****Date:13-07-2023****Subject Name: 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.

		MARKS
Q.1	(a) Briefly write the classification of Control Systems.	03
	(b) Explain close loop system with a suitable example.	04
	(c) Derive transfer function for armature-controlled DC motor with neat sketches.	07
Q.2	(a) Explain the block diagram representation of control system with suitable example.	03
	(b) Briefly explain the linearization of non-linear systems.	04
	(c) Differentiate between Close Loop and Open Loop control systems.	07
	OR	
	(c) Explain Force-Voltage analogy with suitable example.	07
Q.3	(a) Define: (i) State, (ii) State variables, (iii) State space.	03
	(b) Briefly explain the State-space modelling of RLC circuit.	04
	(c) Explain the Mason's gain formula with a suitable example.	07
	OR	
Q.3	(a) Define: (i) First order system, (ii) Second order system.	03
	(b) Explain different types of inputs used for the analysis of control systems with neat sketches.	04
	(c) Derive the unit step response of First order control system and find the steady state error for the same.	07
Q.4	(a) Explain marginally stable system with suitable example.	03
	(b) A close loop system is characterized by the following transfer function: $S^4 + 5S^3 + 5S^2 + 4S + k = 0$. Determine the range of k for which the system is stable.	04
	(c) Plot the Root Locus for a unity feedback system whose forward transfer function is $G(s) = \frac{10(s+1)}{s(s-3)}$	07
	OR	
Q.4	(a) Define: (i) Cut-off rate and (ii) Resonance Peak Frequency, related to frequency response analysis of control systems.	03
	(b) Explain conditionally stable system with suitable example.	04
	(c) Explain the method of plotting Root Locus with suitable example.	07
Q.5	(a) Write frequency transfer function in generalized form and the Bode form.	03
	(b) Briefly explain the advantages of using Nyquist Plot for stability analysis in control systems.	04

- (c) Explain the Phase-lead design using the Bode plot with suitable example. **07**
- OR**
- Q.5** (a) Write the advantages of using Polar plots for system representation in frequency domain. **03**
- (b) Explain Cascade compensation networks with suitable example. **04**
- (c) Explain the Phase-lag design using the Root Locus with suitable example. **07**
