Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3160104 Date:17-05-2024

Subject Name:Basic 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)**	Differentiate between natural and man-made control systems.	**03**
	(b)	List the advantages of using a closed-loop control system over an open-loop control system.	**04**
	(c)	What is SISO,SIMO,MISO and MIMO system in detail?	**07**
Q.2	**(a)**	What is mathematical modeling?	**03**
	(b)	Differentiate between linear and non-linear mathematical models.	**04**
	(c)	Determine the transfer function of the system using Mason's Gain Formula.	**07**
		OR	
	(c)	Define Transfer Function. Derive the transfer function of an RLC circuit.	**07**
Q.3	**(a)**	What is a block diagram in control systems, and what information does it convey.	**03**
	(b)	List the advantages of using signal flow graphs for analyzing control systems compared to block diagrams.	**04**
	(c)	Explain steady state error for Type-0, 1 and 2 systems.	**07**
		OR	
Q.3	**(a)**	Differentiate between transient and steady-state response in control systems.	**03**
	(b)	Explain the time response analysis of control systems and its importance in control system design.	**04**
	(c)	Explain rules for construction of root locus.	**07**
Q.4	**(a)**	Discuss Nyquist criteria for stability.	**03**
	(b)	Differentiate between absolute and relative stability.	**04**
	(c)	Explain steps for designing the Bode plot.	**07**
		OR	
Q.4	**(a)**	What is state space analysis, and how does it differ from the transfer function approach in control systems?	**03**
	(b)	Give one example of a rule used for constructing the root locus of a feedback system.	**04**
	(c)	Derive the Routh-Hurwitz criterion and explain its application in determining the stability of a control system.	**07**
Q.5	**(a)**	Explain ON-OFF controller with dead zone.	**03**
	(b)	List the key elements of a state-space model, including state variables, state equations, and output equation.	**04**
	(c)	Explain phase lag compensator in detail.	**07**

OR

Q.5	**(a)**	Define: (i) State (ii) State Variable (iii) State Vector	**03**
	(b)	Define the terms proportional band, integral gain, and derivative gain in the context of PID control.	**04**
	(c)	Define the term "composite controller" and differentiate between discontinuous and continuous controllers.	**07**

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