Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3151908 Date:16-05-2024

Subject Name: Control Engineering

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)**	Define following terms related to control systems: (i) Transfer Function, (ii) Poles & (iii) Zeros	**03**
	(b)	Write Mason's gain formula for obtaining transfer function from signal flow graph and explain each terms using suitable example.	**04**
	(c)	Explain the block diagram reduction rules to derive overall transfer function of a control system with suitable examples.	**07**
Q.2	**(a)**	Explain the linearization of non-linear systems with a suitable sketch.	**03**
	(b)	Define controlled variables and manipulated variables with suitable example.	**04**
	(c)	Differentiate between open loop and closed loop control systems with suitable examples.	**07**
		OR	
	(c)	Derive transfer function of a fluid system with neat sketches.	**07**
Q.3	**(a)**	Define Rise time, Peak time and Settling time for unit step response of second order systems.	**03**
	(b)	Discuss briefly about standard input test signals for time domain systems with neat sketches.	**04**
	(c)	For a unity-feedback system having open-loop transfer function G(s) as 25 / s(s+5), determine the rise time, settling time, first peak time and maximum percent overshoot when the system is subjected to unit-step input.	**07**
		OR	
Q.3	**(a)**	Define following related to state-space analysis of a control system: (i) State, (ii) State variables, (iii) State space	**03**
	(b)	Briefly explain the conversion of transfer function to a state-space model with a suitable example.	**04**
	(c)	Obtain unit step response of first order system and discuss steady state error for the same.	**07**
Q.4	**(a)**	Write any three salient features of Root Locus plot.	**03**
	(b)	Explain the concepts of Observability and Controllability.	**04**
	(c)	Explain the procedure of drawing Bode plot and determination of gain margin, phase margin and stability with a suitable example.	**07**
		OR	
Q.4	**(a)**	Write steady state error coefficients for type '0'system with Unit step, Unit ramp and Unit parabolic inputs.	**03**
	(b)	Briefly discuss about the relative stability from Nyqist plot.	**04**

	(c)	Explain experimental determination of close loop transfer function with suitable example.	**07**
Q.5	**(a)**	Explain tuning of a PID controller in brief.	**03**
	(b)	Explain hydraulic proportional plus derivative controller with neat sketches.	**04**
	(c)	Explain working of hydraulic PID controller with neat sketches and write transfer function for the same with usual notations.	**07**

OR

Q.5	**(a)**	Explain briefly various elements of pneumatic circuit.	**03**
	(b)	Compare hydraulic and electrical control systems.	**04**
	(c)	Sketch a schematic diagram of pneumatic nozzle-flapper amplifier system and explain its working. Sketch and explain characteristic curve relating nozzle back pressure and nozzle flapper distance for the same.	**07**

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