Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code:3160104 **Date:22-05-2025**

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.**

Q.1	**(a)**	Define transfer function. Discuss advantages and disadvantages of transfer function.	**03**
	(b)	Derive the equation of transfer function of a simple form of closed loop system as shown in Figure 1.	**04**

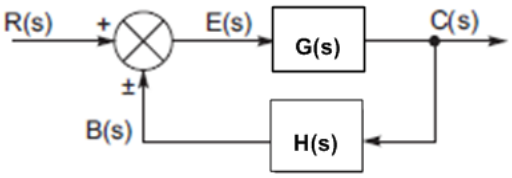

Figure.1

	(c)	Explain open loop and closed loop system with neat diagram. Also, discuss advantages and disadvantages of open loop and closed loop system in detail.	**07**
Q.2	**(a)**	Define the following terminologies in terms of Signal Flow Graph. (1) Node (2) loop (3) forward path.	**03**
	(b)	Derive the transfer function of RLC Series circuit.	**04**
	(c)	Write the procedure to solve Signal Flow Graph (SFG) using Mason's Gain Formula.	**07**
		OR	
	(c)	Discuss the rules of block diagram reduction techniques.	**07**
Q.3	**(a)**	Define: Transient response and steady state response.	**03**
	(b)	Derive the equation of the time response of the first order control system for unit step input function.	**04**
	(c)	Derive steady state error for type-0, type-1 and type-2 systems for the unit step input.	**07**
		OR	
Q.3	**(a)**	Define the following terms: (1) rise time (2) settling time (3) peak time	**03**
	(b)	Explain Routh-Hurwitz stability criterion.	**04**
	(c)	Explain steps for plotting the root locus.	**07**
Q.4	**(a)**	What is absolute stability and relative stability?	**03**
	(b)	Define the following terms. (1) Gain cross over frequency (2) Phase cross over frequency (3) Gain Margin (4) Phase Margin	**04**
	(c)	Explain steps for designing the Bode plot.	**07**
		OR	
Q.4	**(a)**	Define: (1) state (2) state variable (3) state space	**03**

	(b)	Discuss advantages and disadvantages of frequency response.	**04**
	(c)	Compare classical control design with the modern control design.	**07**
Q.5	**(a)**	Explain spring, mass and damper system in detail.	**03**
	(b)	Explain Nyquist stability criterion in brief.	**04**
	(c)	Determine the state space equations of the RLC series network	**07**
		OR	
Q.5	**(a)**	Explain Integral Controller.	**03**
	(b)	Explain ON-OFF controller with dead zone	**04**
	(c)	Write short note on PID Controller.	**07**