Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3151908 Date:25-11-2024

Subject Name:Control Engineering

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)**	Define the terms: a) Control variable b) Manipulated Variable c) Process	**03**
	(b)	Explain with examples: open loop and close loop control system. State their limitations also.	**04**
	(c)	Discuss force voltage and force current analogy with sketches.	**07**
Q.2	**(a)**	Classify the type of control systems and explain time variant system with suitable example.	**03**
	(b)	Define the transfer function and discuss its characteristics.	**04**
	(c)	Obtain the transfer function of the block diagram given in fig. 1 using block diagram reduction technique.	**07**
		OR	
	(c)	Using Mason's Gain formula, obtain the transfer function of the signal flow graph shown in fig. 2.	**07**
Q.3	**(a)**	Define: State variable, state vector and state space	**03**
	(b)	Enlist Advantage and Disadvantages of state space analysis technique.	**04**
	(c)	Obtain a state-space representation of the system shown in Fig. 3	**07**
		OR	
Q.3	**(a)**	Explain when the system is said to be underdamped, overdamped and critically damped for a second order unity feedback control system with step input.	**03**
	(b)	Discuss the effect of adding integral control action to a first order unity feedback proportional control system with step input.	**04**
	(c)	Obtain the transfer function of the Thermal system shown in fig. 4. Assume suitable notations.	**07**
Q.4	**(a)**	Define: Peak time, Rise time, Steady state error.	**03**
	(b)	Comment on the stability of the system defined by $s^4 + Ks^3 + s^2 + s + 1$=0.	**04**
	(c)	With usual notations, derive the unit step response of first order time invariant system.	**07**
		OR	
Q.4	**(a)**	What is Phase margin and Gain margin? State importance of it.	**03**
	(b)	Compare Routh's stability criteria and Nyquist stability criteria.	**04**
	(c)	Draw the root locus of the system represented by the fig. 5.	**07**
Q.5	**(a)**	Explain nozzle -flapper amplification in a pneumatic system.	**03**

	(b)	Compare the hydraulic and pneumatic systems.	**04**
	(c)	Explain working of Hydraulic PI controller with neat sketch. State the advantages also.	**07**

OR

Q.5	**(a)**	Explain tuning of PID controller in brief.	**03**
	(b)	Explain the basic components of the hydraulic control system.	**04**
	(c)	Explain pneumatic force-balance type Proportional controller with neat sketch and state limitations.	**07**

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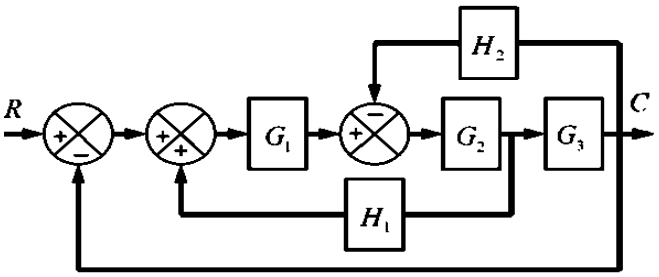

Fig. 1

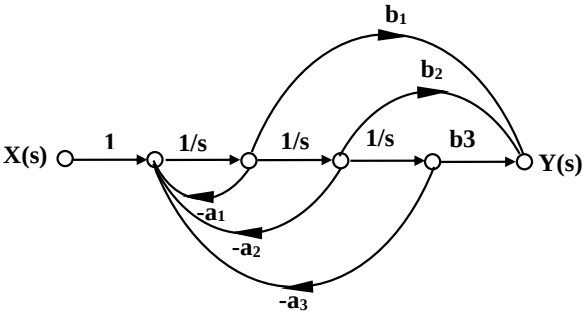

Fig.2

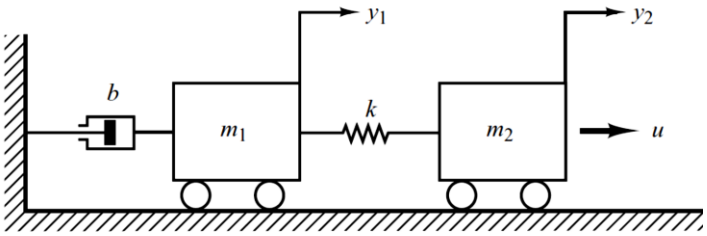

Fig. 3

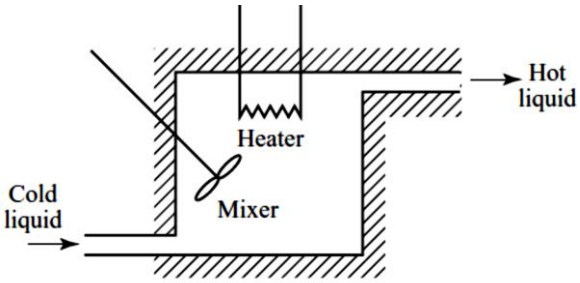

Fig. 4

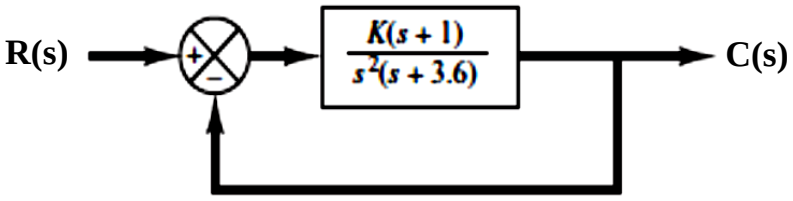

Fig. 5