Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2183607 **Date:15/05/2019**

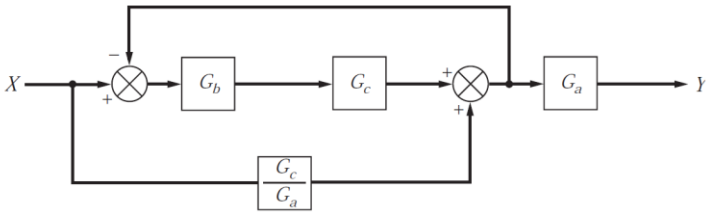
Subject Name:Process Instrumentation, Dynamics & Control

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.**

			MARKS
Q.1	**(a)**	Mention the following terms relating to control system (i) set point tracking (ii) disturbance rejection (iii) block diagram	**03**
	(b)	Write a short note on characteristics of laplace transform mentioning it for input of unit step function .	**04**
	(c)	Find the laplace transform of function x(t) that satisfies the differential equation and initial conditions $$\frac{d^3x}{dt^3} + 2\frac{d^2x}{dt^2} - \frac{dx}{dt} - 2x = 2$$ $$x(0) = 1, \quad x'(0) = 0, x''(0) = -1$$	**07**
Q.2	**(a)**	State and prove final value theorem.	**03**
	(b)	Write the systematic procedure for determining transfer function of a process.	**04**
	(c)	A thermometer exhibiting first order dynamics having a time constant of 5 sec is at a steady state temperature of 25°C. At time t = 0 , the thermometer is placed in a temperature bath at 70 °C. Show that value of response reaches 63.2 % of its ultimate vale when time elapsed is equal to one time constant.	**07**
		OR	
	(c)	Derive the transfer function of first order system of mercury in thermometer mentioning assumptions involved.	**07**
Q.3	**(a)**	A control system is subjected to a step change of magnitude 10. The transfer function of the control system is expressed as $$G(s) = \frac{6}{0.9s^2 + 0.3s + 10}$$ Calculate (i) overshoot (ii) Radian frequency (iii) Decay ratio	**03**
	(b)	Mention characteristic features of an underdamped second order system for a step forcing function.	**04**
	(c)	Derive the transfer function relating head to that of flow rate for liquid level system connected in a noninteracting manner	**07**
		OR	
Q.3	**(a)**	A PI controller with integral time τ_I 1 min having a sensitivity K_C = 1. The error is subjected to a linear change of 3 °C/min. Obtain response equation of controller.	**03**
	(b)	Describe a second order system. Mention how the response in such a system varies with variables characterizing the system.	**04**
	(c)	Derive the step response of an underdamped second order system.	**07**

Q.4	**(a)**	How stability is mentioned for linear systems?	**03**
	(b)	For the case of a servo problem prove that an increase in controller gain will reduce the value of offset.	**04**
	(c)	Determine the transfer function Y(s)/X(s) for the system as shown in the figure 	**07**

OR

Q.4	**(a)**	Differentiate Servo problem and regulator problem.	**03**
	(b)	Mention the rule for plotting root locus diagram for a negative feedback system.	**04**
	(c)	Obtain the response of a regulator problem for a change in load variable.	**07**
Q.5	**(a)**	Mention various laws of thermoelectricity.	**03**
	(b)	Write a short note on McLeod Vacuum gauge.	**04**
	(c)	Describe various static and dynamic characteristics of measuring instruments.	**07**

OR

Q.5	**(a)**	Write a short note on pressure measurement scales.	**03**
	(b)	Describe the working of pressure spring thermometer.	**04**
	(c)	With a neat diagram explain how venturimeter is used for measuring flow deriving the equation for discharge.	**07**

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