Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150504 Date:07/06/2022

Subject Name:Instrumentation and Process Control

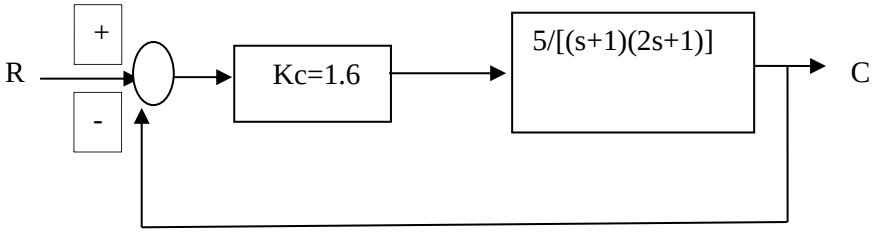
Time:02:30 PM TO 05:00 PM Total Marks: 70

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 step and input function.	**03**
	(b)	Find the Laplace transform of f(t) = 1 & f(t) = t	**04**
	(c)	Derive the transfer function of mercury thermometer. Determine the response equation of mercury thermometer for step function.	**07**
Q.2	**(a)**	Solve $\frac{dx}{dt} + 3x = 0, x(0) = 2$	**03**
	(b)	Derive the transfer function for Interacting system.	**04**
	(c)	Solve the following differential equation by Laplace transform: $$\frac{d^3x}{dt^3} + 2\frac{d^2x}{dt^2} - \frac{dx}{dt} - 2x = 4 + e^{2t}$$ $$x(0) = 1,\ x'(0) = 0,\ x'' = -1$$	**07**
		OR	
	(c)	Find the inverse Laplace Transform of the function: $$\bar{x}(s) = \frac{4S + 5}{(S-1)^2(S+2)}$$	**07**
Q.3	**(a)**	Define dead zone and dead time lag	**03**
	(b)	Explain Servomechanism type problem and Regulator problem	**04**
	(c)	Define second order system. Derive the transfer function of U-Tube Manometer	**07**
		OR	
Q.3	**(a)**	Derive transfer function for transportation lag.	**03**
	(b)	Define: overshoot, decay ratio, response time and period of oscillations.	**04**
	(c)	Write a note on Bellows differential pressure element with neat sketch.	**07**
Q.4	**(a)**	Distinguish between Negative Feedback and Positive Feedback.	**03**
	(b)	Describe the importance of root locus method in brief.	**04**
	(c)	Discuss pressure spring thermometer with neat sketch.	**07**
		OR	
Q.4	**(a)**	Highlight on hygrometer & hydrometer.	**03**
	(b)	Differentiate between Open loop and closed loop control system.	**04**
	(c)	Given the characteristic equation, determine the stability by the Routh criterion $s^4 + 3s^2 + 5s^2 + 4s + 2 = 0$	**07**
Q.5	**(a)**	Describe PLC, DCS, and SCADA in brief.	**03**
	(b)	Describe the bubbler system for liquid level measurement with neat sketch.	**04**

(c) The set point of the control system shown in figure below is given a step change of 0.1 unit. Determine: (a) The maximum value of C and (b) The offset. **07**



OR

Q.5 **(a)** Write significance of gain margin and phase margin. **03**

(b) What is offset? Explain P, PI and PID controller. **04**

(c) Plot the bode diagram for the system whose overall transfer function is 1/(s+1)(s+5) **07**

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