GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150504   **Date:29/01/2021**

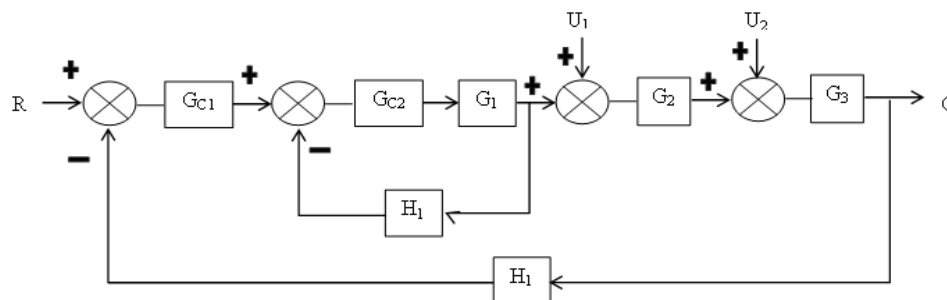**Subject Name:Instrumentation and Process Control**

Time:10:30 AM TO 12:30 PM   **Total Marks: 56**

Instructions:
1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

			Marks
Q.1	**(a)**	Give the Theoretical value of time constant of the following first order systems: 1. Mercury thermometer 2. Mixing process 3. Liquid level single tank system	**03**
	(b)	Determine f(t) for $f(s) = 1/[s^2(s + 1)]$	**04**
	(C)	A square storage tank contains a liquid which is pumped by a centrifugal pump at a steady rate. Liquid enters the tank at a volumetric flow rate 200 Liter Per Hour and liquid level reaches steady-state value of 40 cm. if input flow rate is suddenly increased to 300 Liter Per Hour. Find the level response and Height of Liquid after 1 min.(Cross Section Area of tank is 15 centimeter x 15 centimeter)	**07**
Q.2	**(a)**	Give the Laplace transform of the following 1. Cosh kt u(t) 2. Sin kt u(t) 3. t^n u(t)	**03**
	(b)	Derive the Laplace transforms of Step and Sine forcing function.	**04**
	(c)	Prove that Response of Non-interacting tanks always result in an overdamped or critically damped second order system and never in an underdamped.	**07**
Q.3	**(a)**	What is difference between Open-loop and Close-loop control system?	**03**
	(b)	Explain the following for underdamped response of second order system. 1. Overshoot 2. Decay Ratio 3. Rise Time 4. Response Time	**04**
	(c)	Determine the transfer function C/R for the system shown in Figure.	**07**

Q.4 **(a)** Discuss the special case application of proportional control in ON-OFF control system. **03**

(b) What is Regulator-type problem in control system? Explain with example. **04**

(c) The characteristic equation of control system is given as following. **07**

$S^3 + 6s^2 + 11s + 6(1 + Kc) = 0$

Determine:

1. The Value of Kc for which the control system is stable.
2. The roots of the characteristic equation for the value of Kc for which the system is on the threshold of instability.

Q.5 **(a)** Discuss the various components of a control system with example. **03**

(b) Explain advantages and disadvantages of Distributed Control System. **04**

(c) Discuss the rules for plotting Root-Locus Diagram for Negative Feedback control system. **07**

Q.6 **(a)** What is difference between P and PID control? **03**

(b) Explain the Routh theorems for stability test of control system. **04**

(c) Explain the Ziegler-Nichols Controller rule for setting of parameter in P, PI, and PID feedback control system. **07**

Q.7 **(a)** List various static characteristics of instruments and discuss any one in details **03**

(b) What is difference in working between radiation pyrometer and optical pyrometer? **04**

(c) List the various instruments used for measurement of vacuum. Explain construction and working of McLeod gage. **07**

Q.8 **(a)** Explain SCADA system. **03**

(b) List the various instrument used for measurement of humidity. Explain working of wet bulb and dry bulb thermometer used for measurement of relative humidity. **04**

(c) Explain the construction, working and application of Magnetic float gauge. **07**

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