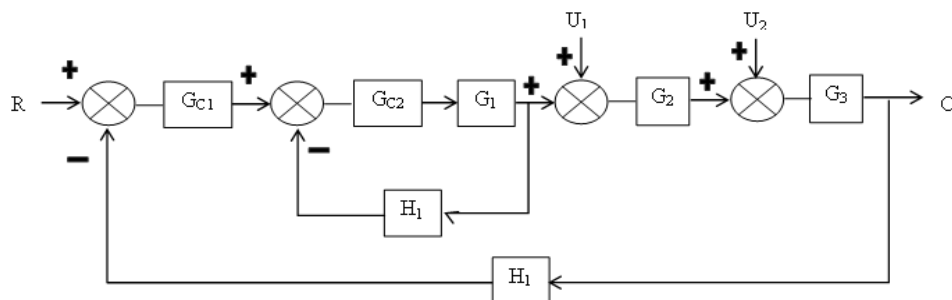


GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020****Subject Code:3150504****Date:29/01/2021****Subject Name:Instrumentation and Process Control****Time:10:30 AM TO 12:30 PM****Total Marks: 56****Instructions:**

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: | 03 |
| 1. Mercury thermometer
2. Mixing process
3. Liquid level single tank system | |
| (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 | 03 |
| 1. $\cosh kt u(t)$
2. $\sin kt u(t)$
3. $t^n u(t)$ | |
| (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. | 04 |
| 1. Overshoot
2. Decay Ratio
3. Rise Time
4. Response Time | |
| (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**
 $S^3 + 6s^2 + 11s + 6(1 + K_c) = 0$
Determine:
1. The Value of K_c for which the control system is stable.
2. The roots of the characteristic equation for the value of K_c 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**
