Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V EXAMINATION – SUMMER 2025

Subject Code:3150504 Date:28-05-2025

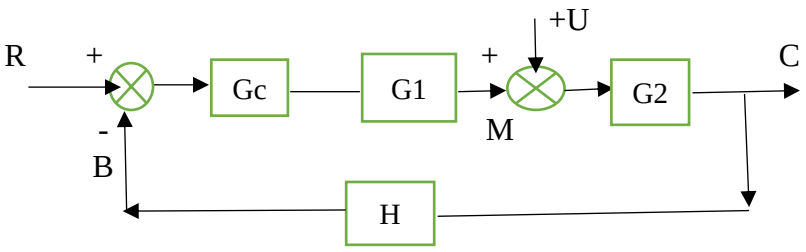
Subject Name:Instrumentation and Process Control

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.**

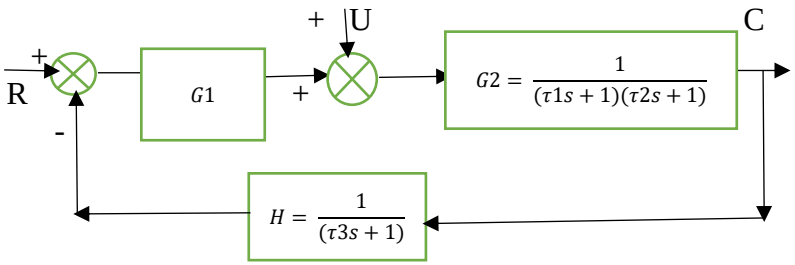
			MARKS
Q.1	**(a)**	Explain Transportation lag with transfer function.	**03**
	(b)	Derive and plot the response of impulse function for first order system $\frac{Y(s)}{X(s)} = \frac{1}{\tau s+1}$.	**04**
	(c)	Prove that for liquid level system with constant flow outlet the step change in initial flow rate gives response as a ramp function which grows without limit.	**07**
Q.2	**(a)**	Show that the ultimate change in height $H(t)$ for a unit step change in initial flowrate $Q(t)$ is simply resistance R.	**03**
	(b)	Discuss Overshoot in process control with suitable example.	**04**
	(c)	For second order critically damped system find the value of Y(t) for unit step change in X(t). $\frac{Y(s)}{X(s)} = \frac{1}{\tau^2 s^2+2\varepsilon\tau s+1}$	**07**
		OR	
	(c)	Explain the Cohen – Coon controller tuning method for setting of parameter in P, PI, and PID feedback control system.	**07**
Q.3	**(a)**	Discuss the selection criteria for the controller based on the Offset value.	**03**
	(b)	Why negative feedback systems are used in Process Control?	**04**
	(c)	Determine stability using Root locus diagram for the open loop transfer function $G(s) = \frac{Kc}{(s+1)(0.5s+1)}$	**07**
		OR	
Q.3	**(a)**	Find the overall transfer function C(S)/U(S) for change in load (R= 0) for given control system	**03**



	(b)	Draw Piping and instrumentation diagram for control system of heat exchanger with suitable labelling.	**04**
	(c)	Discuss in detail about Pneumatic control valve with figure.	**07**

Q.4 **(a)** Write in brief about ON / OFF control. **03**

(b) Determine the stability of the system shown in Fig. for which a PI controller is used. Use τ_1 =1, τ_2 =1/2, τ_3 = 1/3, kc = 5 and τ_I = 0.25 using routh criteria. $G1 = kc(1 + \frac{1}{\tau IS})$ **04**



(c) Draw Bode diagram plots for first order system having Amplitude Ratio AR $= \frac{1}{\sqrt{\tau^2\omega^2+1}}$ **07**

OR

Q.4 **(a)** Describe Peltier effect of thermocouple. **03**

(b) Draw figure for capillary type viscometer with suitable labelling. **04**

(c) Discuss DCS (Distributed Control System) in detail. **07**

Q.5 **(a)** Define: 1) Span 2) Drift 3) Error **03**

(b) Explain principle and working of displacement float gauge for level measurement. **04**

(c) Discuss Bellow electrical pressure gauge with suitable figure. **07**

OR

Q.5 **(a)** Discuss Wet bulb thermometer for humidity measurement. **03**

(b) Describe the working of Rotameter. **04**

(c) Explain Ratio control with suitable example. **07**

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