BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP2024)

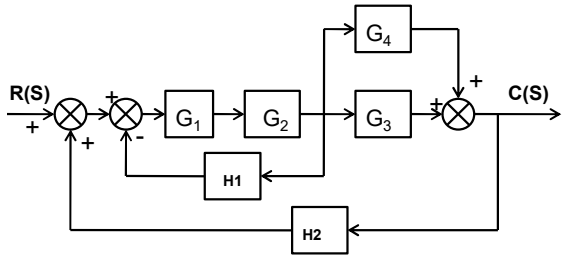
CLASS: B. TECH. **SEMESTER: VI**
BRANCH: CHEMICAL ENGG. **SESSION: SP/2024**

SUBJECT: CL333 PROCESS CONTROL & INSTRUMENTATION

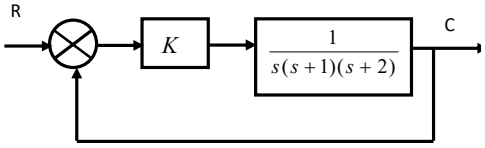
TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates:**

			CO	BL
Q.1(a)	State the degree of freedom and how to reduce it?	[2]	CO1	2
Q.1(b)	In a distillation column separation process is going on, where distillate fraction needs to be controlled. Draw the feedback loop for enriching section with appropriate blocks to get the pure distillate fraction. What will be the types of control valve to maintain the distillate flowrate and controller action recommended for this system and why?	[3]	CO1 CO2	3
Q.2(a)	Define offset, servo problem and regulator problem.	[2]	CO2	1
Q.2(b)	Derive the transfer functions for temperature control in a stirred tank heater (assume that the liquid level remains constant).	[3]	CO2	3
Q.3(a)	Show that as the number of noninteracting first-order systems in series increases, the response of the system becomes more sluggish.	[2]	CO2	3
Q.3(b)	Solve the following linear differential equation using Laplace transforms: $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} - y = 5t \quad with \;\; y'(0) = 0 \;\&\; y(0) = 2$	[3]	CO2	3
Q.4(a)	An impulse response of magnitude 4 is introduced into a system having the transfer function. $\frac{Y(s)}{X(s)} = \frac{1}{s^2 + s + 1}$ Determine: a) Percent overshoot, b) Rise time, c) Ultimate value of Y(t), d) Maximum value of Y(t), e) Period of oscillation.	[2.5]	CO2	4
Q.4(b)	Reduce the block diagram to a single block and find C/R.	[2.5]	CO2	4



Q.5(a)	Determine the values of K for which the system becomes stable/unstable using Routh's test.	[5]	CO3	4



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