Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

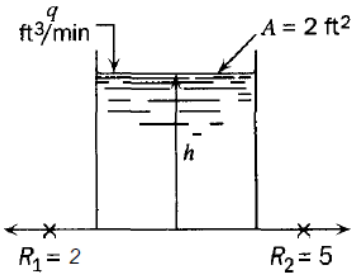
UPES, Dehradun
End Semester Examination, April-May 2024

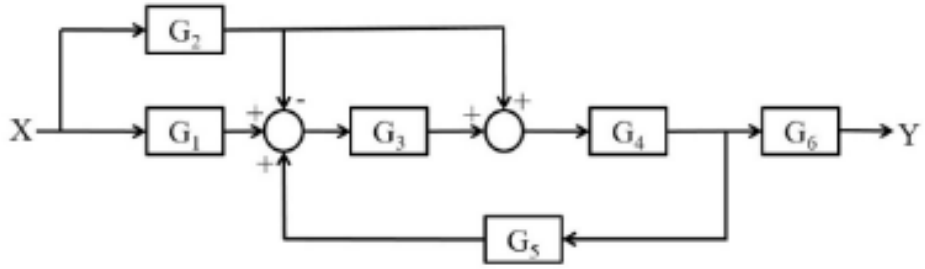
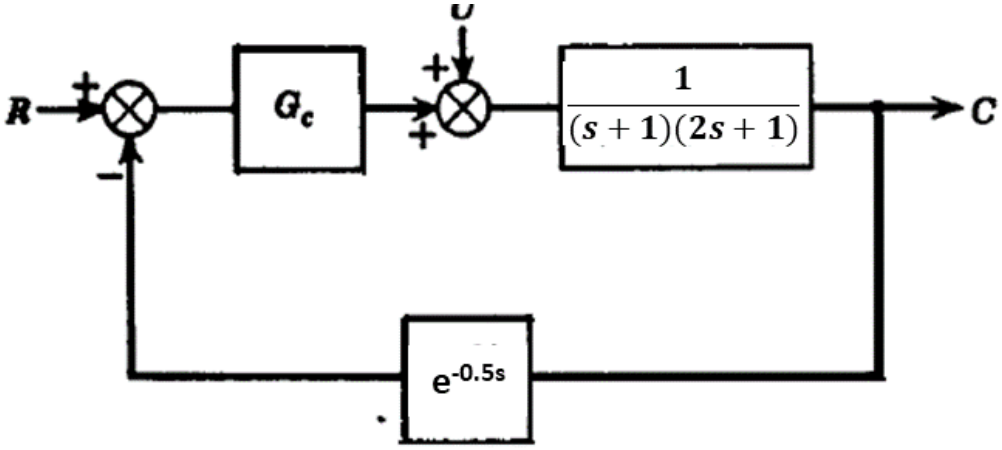
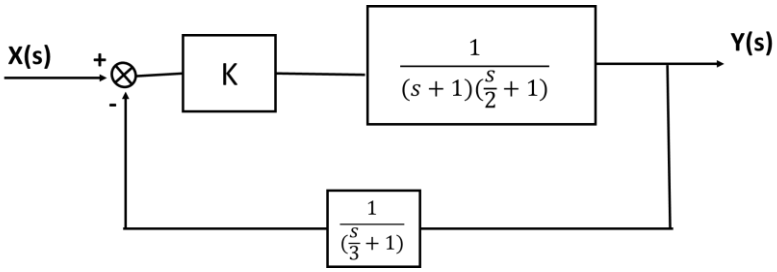
Program Name : B. Tech. (CE&RP) **Semester : VI**
Course Name : Process Dynamics Instrumentation & control **Time : 3 hours**
Course Code : CHCE3007 **Max. Marks : 100**
Nos. of page(s) : 02
Instructions : Assume any missing data. Draw the diagrams, wherever necessary. Write roll number and name on any additional sheet that you use.

SECTION A
(5X4=20 marks)

S. No.		Marks	CO
1	*Identify* the terms used in underdamped second order system?	**4**	**CO1**
2	*List* the assumptions used in the mercury in glass bulb thermometer model.	**4**	**CO1**
3	*Describe* damping?	**4**	**CO2**
4	*Summarize* Routh stability criterion.	**4**	**CO2**
5	*Demonstrate* the way how root locus is plotted	**4**	**CO3**

SECTION B
(4X10=40 marks)

6	Outline the following differential equations using Laplace Transforms. a) $\frac{dx}{dt} - x = e^{3t}$ $\quad x(0) = 2$ b) $\frac{d^2x}{dt^2} - \frac{dx}{dt} + 2x = e^{3t}$ $\quad x(0) = 1 \; and \; x'(0) = 0$	**10**	**CO1**
7	There are N storage tank of volume V Arranged so that when water is fed into the first tank into the second tank and so on. Each tank initially contains component A at some concentration Co and is equipped with a perfect stirrer. A time zero, a stream of zero concentration is fed into the first tank at volumetric rate q. Predict the resulting concentration in each tank as a function of time.	**10**	**CO2**
8	 *Demonstrate* expression for H(s)/Q(s). Substitute the appropriate values in the transfer function and report.	**10**	**CO3**
9	*Appraise* the reducion of given block diagram and find Y/X	**10**	**CO4**

			
SECTION C (2 X 20=40 marks)			
10	Without plotting the bode diagram, evaluate the tuning parameters for PID controller using Ziegler and Nichols control settings.  **OR** Plot the root locus for the open loop transfer function $1 + \frac{K(0.5s+1)}{s(s+1)(2s+1)}$	**20**	**CO5**
11	a) In the control system shown above, *interpret* the value of K for which the system is stable. The controller is replaced by a PI controller with transfer function $K\left(1+\frac{1}{\tau_I s}\right)$. If K = 10, determine the range of τ_I for which the system is stable.  b) Three identical tanks are operated in series in a non-interacting fashion. For each tank R=1, τ = 1. If the deviation in flow rate to the first tank in an impulse function of magnitude 2, Predict an expression for H(s) where H is the deviation in level in the third tank and obtain the deviation value at time t=1.5.	**10** **10**	**CO4**