Name: **Enrolment No:**	

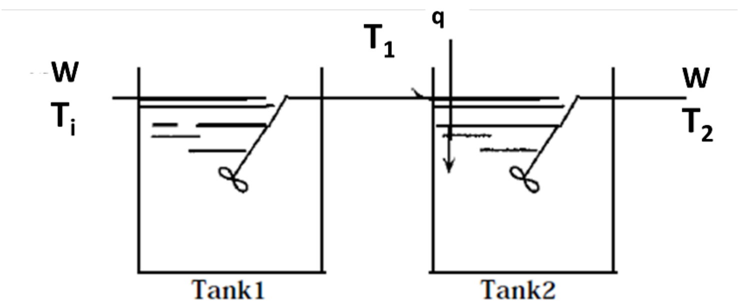
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

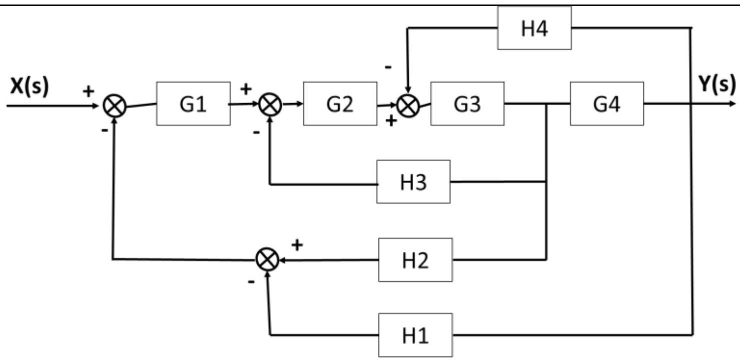
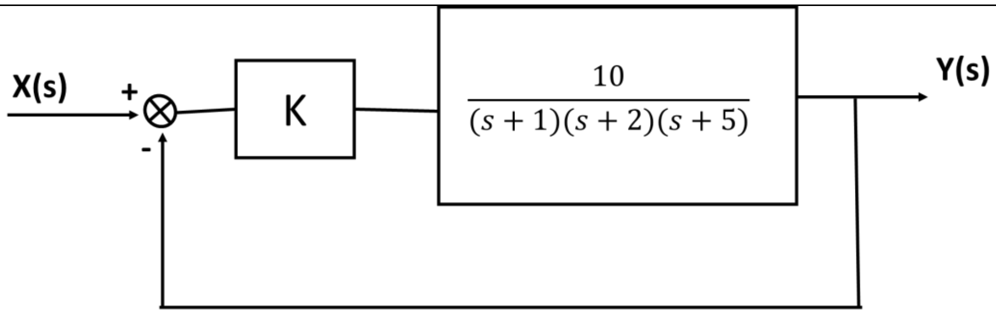
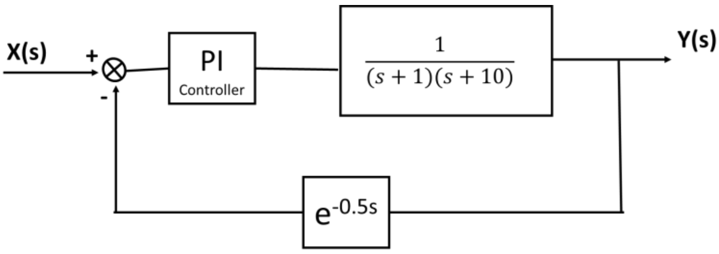
End Semester Examination, May 2023

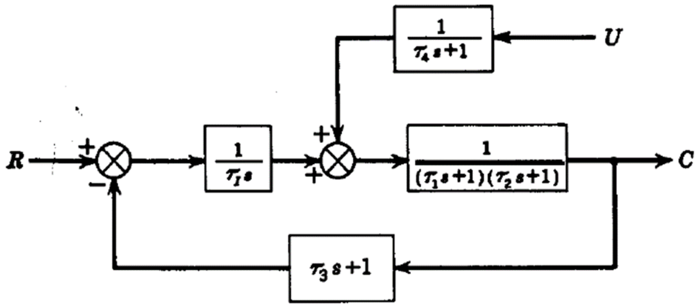
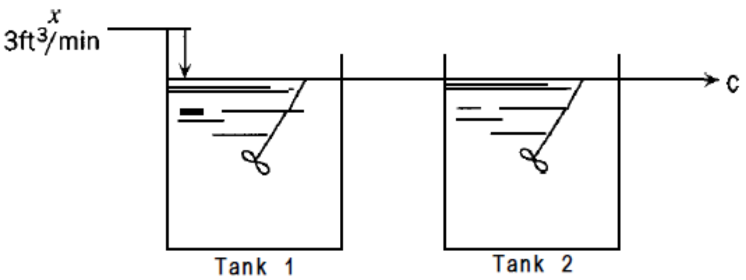
Program Name : B. Tech. (CERP) **Semester : VI**
Course Name : Process Dynamics Instrumentation & control **Time : 3 hours**
Course Code : CHCE 3007 **Max. Marks : 100**
Nos. of page(s) : 03

Instructions : Assume any missing data. Draw the diagrams, wherever necessary. Write roll number and name on any additional sheet that you use.

SECTION A
(6X10=60 marks)

S. No.		Marks	CO
1	***Identify*** the following differential equations using Laplace Transforms. a) $\frac{dx^2}{dt^2} - 5\frac{dx}{dt} + 6x = 0 \qquad x(0) = x'(0) = 2$ b) $\frac{dx}{dt} - x = e^{3t} \qquad x(0) = 0$	**10**	**CO1**
2	A process of unknown transfer function is subjected to a unit impulse input. The output of the process is measured accurately and is found to be represented by the function Y(t) = t e^{-t}. **Describe** the unit step response in this process.	**10**	**CO2**
3	The two-tank heating process shown below consists of two identical, well stirred tanks in series. **Sketch** and develop a block diagram that relates the outlet temperature of tank 2 to the inlet temperature to tank 1 and the flow of heat to tank 2. 	**10**	**CO3**

4	 **Connect** Y(s) and X(s) as a transfer function.	10	CO4
5	 Given the control diagram shown in above figure, by means of the Routh criterion ***compose*** those values of Kc for which the output C is stable for all inputs of R. Find the roots when the system is on the verge of instability.	10	CO5
6	Using Ziegler-Nichols rules, ***estimate*** proportional gain, derivative and integral time for the system shown below. (Do not plot the bode diagram and use Bode stability criterion) 	10	CO6
SECTION B **(2 X 20=40 marks)**			
7	**Summarize** the root locus diagram for the open loop transfer function. $$\frac{K(s+1)}{s^2(s+3.6)}$$ **OR** Given the control diagram shown below, ***Construct*** by means of the Routh criterion those values of τ_I for which the output C is stable for all inputs R and U.(express τ_I in terms of τ_1 τ_2 and τ_3 .	20	CO5

			
8	In the two- tank mixing process shown below, x varies from 0 lb salt/ft^3 to 1 lb salt/ft^3 according to step function. **Design** the time at which the salt concentration in tank 2 reaches 0.6 lb/ ft^3? The hold up volume of each tank is 6 ft^3. 	**20**	**CO3**