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

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

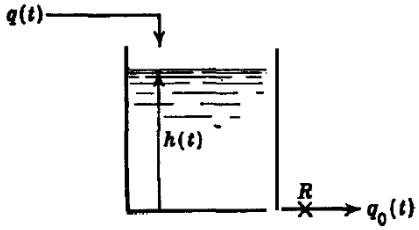
Program Name : B. Tech. (APE Gas) **Semester : VII**
Course Name : Process Dynamics & Control **Time : 3 hours**
Course Code : CHCE 4009P **Max. Marks : 100**
Nos. of page(s) : 03

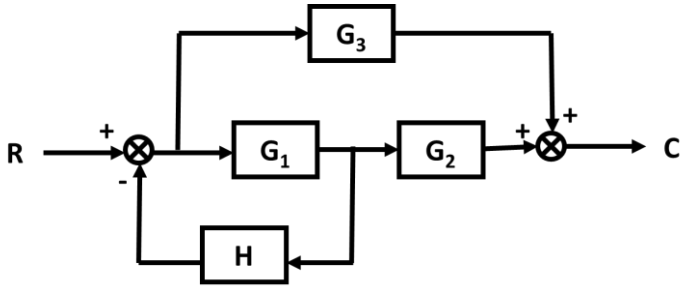
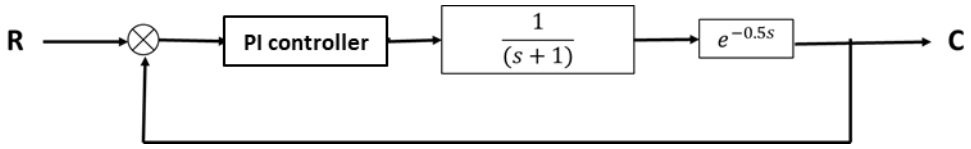
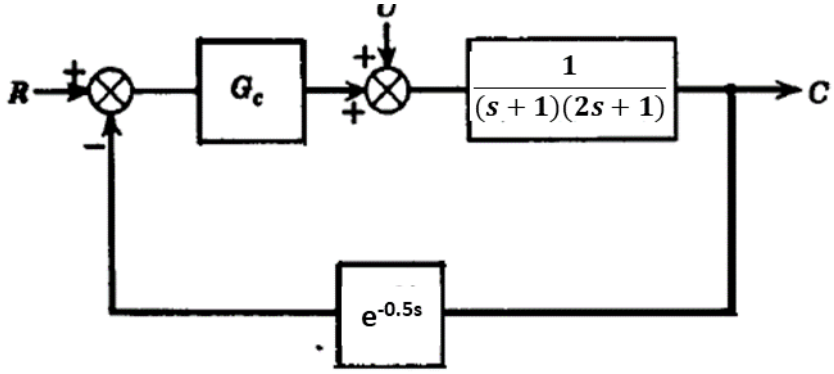
Instructions : Assume any missing data. Draw the diagrams, wherever necessary Write roll number and name on any additional sheet that you use.

SECTION A
(4X5=20 marks)

S. No.		Marks	CO
1	How to ***identify*** a first order system?	**4**	**CO1**
2	***Tell*** about a linear system in the liquid level process.	**4**	**CO1**
3	***Explain*** how the controllers are classified?	**4**	**CO2**
4	***Demonstrate*** in brief about the Bode diagrams.	**4**	**CO3**
5	***Demonstrate*** the use of advanced control systems in the industry.	**4**	**CO3**

SECTION B
(4X10=40 marks)

6	***Identify*** the following differential equations using Laplace Transforms. a) $\frac{dx^2}{dt^2} + 3\frac{dx}{dt} + x = 1 \qquad x(0) = x'(0) = 0$ b) $\frac{d^2x}{dt^2} + 9x = cos2t \qquad x(0) = 1 \; and \; x'(0) = A$	**10**	**CO1**
7	A block of mass Wresting on a horizontal, frictionless table is attached to a linear spring. A viscous damper (dashpot) is also attached to the block. Assume that the system is free to oscillate horizontally under the influence of a forcing function F(t). The origin of the coordinate system is taken as the right edge of the block when the spring is in the relaxed or unstretched condition. At time zero, the block is assumed to be at rest at this origin. ***Describe*** the transfer function for the following classical example from mechanics.	**10**	**CO2**
8	A liquid level system is as shown below. Height of the fluid h varies as a function of flow rate, linearly. ***Interpret*** the transfer function relating the height of the tank with the inlet flow into the tank. 	**10**	**CO3**

9	***Infer*** and Reduce the given block diagram and find C/R 	**10**	**CO4**
SECTION B **(2 X 20=40 marks)**			
10	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)  **OR** Plot the bode ***diagram*** for the following control loop and evaluate the tuning parameters for PID controller using Ziegler and Nichols control settings. 	**20**	**CO5**
11	With neat diagrams and appropriate process and block diagrams ***explain*** a) Feed forward control system b) Ratio control system	**20**	**CO6**