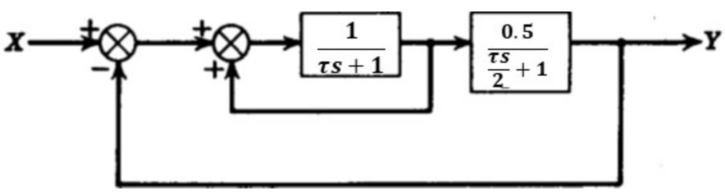
Name: **Enrolment No:**	

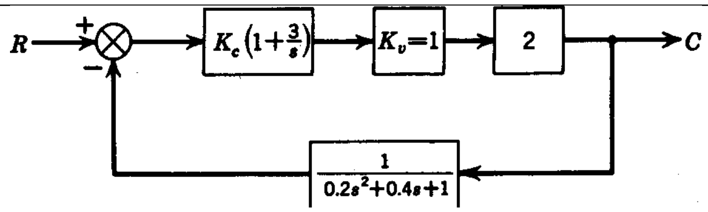
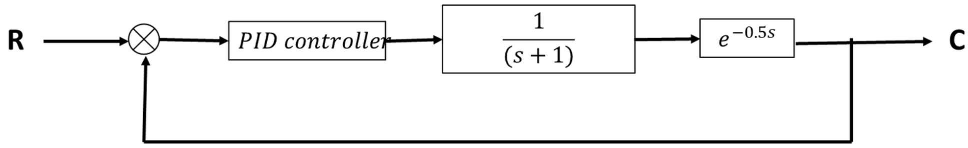
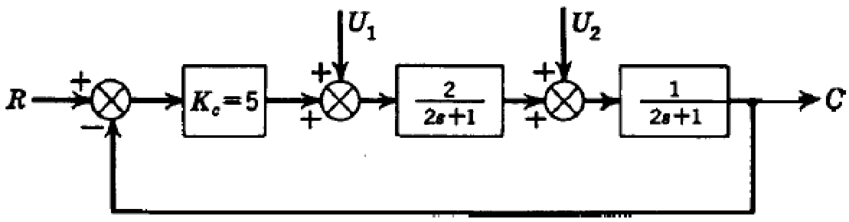
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2022

Program Name : B. Tech. (CERP) **Semester : VI**
Course Name : Process Control **Time : 3 hours**
Course Code : CHCE 3033 **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) $\frac{dx}{dt} - x = 2\sin t \; x(0) = 0$ b) $\frac{d^2x}{dt^2} + \frac{dx}{dt} + x = 1 \; x(0) = x'(0) = 0$	**10**	**CO1**
2	A thermometer having first order dynamics with a time constant of 1 min is placed in a temperature bath at 100 deg F. After the thermometer reaches steady state, it is suddenly placed in bath at 100 deg F at t = 0 and left there for 1 min after which it is immediately returned to the bath at 100 deg F. ***Indicate*** the thermometer reading at t = 0.5 min and at t = 2.0 min	**10**	**CO2**
3	The overall transfer function of the process is given by $\frac{16}{1.5s^2 + 2.4s + 6}$. If a step change of magnitude 6 is introduced into the system, ***Illustrate*** 1. Overshoot 2. Period of oscillation 3. Rise time 4. Ultimate value 5. Maximum value of response	**10**	**CO3**
4	a) Reduce the given block diagram and find Y/X  b) 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 $y(t) = te^{-t}$. ***Analyze*** the unit-step response of this process.	**5** **5**	**CO4**

5	 Determine the stability of the above closed loop system using Routh criteria. ***Appraise*** the roots of the characteristic equation, when the system is on the verge of unstable condition.	10	CO5
6	Using Ziegler-Nichols rules, **compose** proportional gain, derivative and integral time for the system shown below. (Do not plot the bode diagram and use Bode stability criterion)  **OR** ***Explain*** Cohen and Coon rules for tuning a controller.	10	CO6
SECTION B **(2 X 20=40 marks)**			
7	The location of a load change in a control loop may affect the system response. In the block diagram shown below, a unit-step change in load enters at either location 1 or location 2. ***Calculate*** the offset when the load enters at location 1 and when it enters at location 2?  **OR** Plot the root locus ***diagram*** for the open loop transfer function $\frac{K}{s(s+3)(s^2+2s+2)}$	20	CO5
8	With neat diagrams and appropriate process and block diagrams ***explain*** a) Cascade control system b) Ratio control system	20	CO6