

**Ref. No. - Ex/PG/ChE/PE/T/113A**  
**M.Ch.E Chemical Engineering 1<sup>st</sup> Year 1<sup>st</sup> Semester Exam-2025**  
**Department of Chemical Engineering, Jadavpur University**

Odd Semester –July-Dec’2024

Session: 2024-25

M.Ch.E- 1<sup>st</sup> Year

Subject: Process Dynamics and Control (PG/ChE/PE/T/113A)

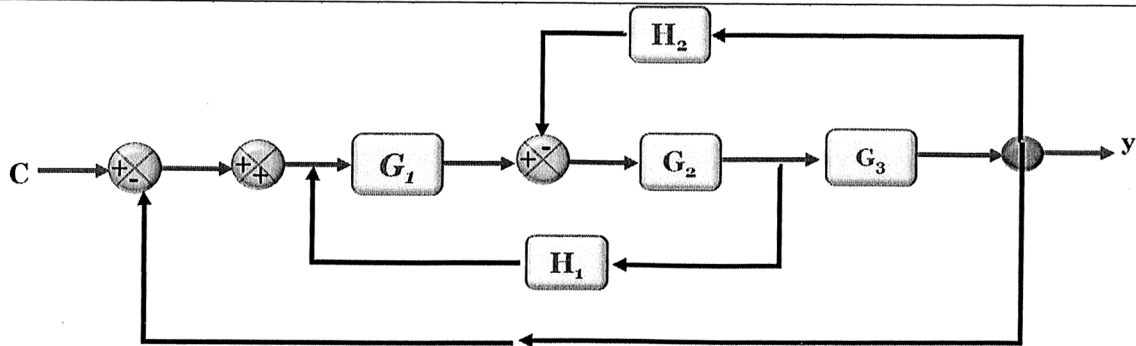
Time: 3 hr

Full Marks: 100

**(Attempt all questions)**

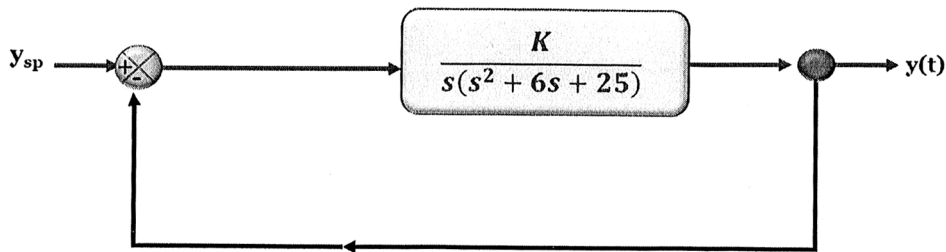
		Marks
<b>CO2</b>		
Q1	<p>a) Consider a closed loop transfer function for a second order system is</p> $G(s) = \frac{4}{(s^2+4s+4)}$ <p>Calculate the settling time for a 2% and 5% band. And also determine the peak time and rise time with percentage overshoot.</p> <p>b) The transfer function of a second order system is given below</p> $G(s) = \frac{s+2}{(s^2+2s+4)}$ <p>Determine the poles of the control system and place them on complex co-ordinate system and also analyze the unit step response of this system using the inverse of Laplace transform and plot the response.</p> <p>c) Solve the Laplace transform</p> $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 4x = e^{2t} \quad ; \quad x(0) = 0 \text{ and } x'(0) = 1$	<p>15</p> <p>15</p> <p>10</p>
<b>CO3</b>		
Q2	<p>a) Derive the servo and regulator transfer functions if a control system is introduced by the following block diagram</p> <div style="text-align: center;"> </div> <p>b) Compute the transfer function of the depicted block diagram by reduction.</p>	<p>15</p>

[ Turn over



10

c) Sketch the root loci of the system shown in figure.



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**CO4**

- Q3 a) Suppose you have a heat exchanger to heat or cool a process fluid to get a desired temperature by steam. The sketch block diagram with details if you use the cascade control system.
- b) In what cases the split range control system is employed? - Clarify it with examples.

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