



Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Process Control – ICEG 341
Program: B.Tech. Instrumentation and Control
Time: 03 hrs.

Semester: VI

Max. Marks: 100

Instructions:

- 1) Answers should be brief and concise.
- 2) Assume any missing data.

SECTION A**All questions are compulsory**

S. No.	Question statement	Marks	CO
Q 1	Differentiate between a Servo and a Regulator control system.	5	CO1
Q 2	Elucidate the working of a “ heat exchanger ”.	5	CO2
Q 3	Elucidate block diagram of a “ Feedforward Control System ”. How is it different from a feedback control system?	5	CO3
Q 4	As a process control engineer briefly explain the process conditions when a designer opts for “ Inferential Control ”.	5	CO3

SECTION B**All questions are compulsory. Internal choice is given in question 8**

Q 5	Explain the term “ Inverse Response ” with respect to a process control system. How does it affect the process output? Draw the time response for such systems.	10	CO2
Q 6	Deduce the mathematical model of a “ MIMO ” process model. Explain the term “ interaction ” of the loops.	10	CO2
Q7	For boiler steam distribution system design following control configurations: a. “ Ratio control ” system while considering the high pressure line as the wild stream and low pressure line as controlled stream. b. “ Protection control loop ” for high pressure line.	5+5	CO3
Q 8	For a closed loop process as describe in figure 1. Enumerate the effect of adding an “ Integral controller ” for a first order process. Here assume $G_v = G_m = 1$. <p style="text-align: center;">OR</p> For a closed loop process as describe in figure 1. Enumerate the effect of adding a “ Derivative controller ” for a first order process. Here assume $G_v = G_m = 1$.	10	CO4

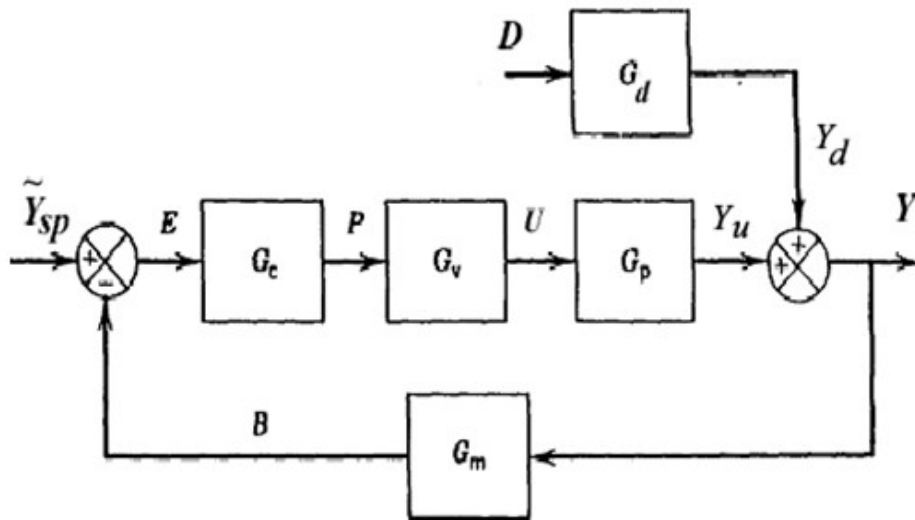


Figure 1 Q8 – Closed loop control block diagram

SECTION-C

All questions are compulsory. Internal choice is given in question 10

- Q 9 For the jacketed CSTR system as depicted in figure 2:
- Identify the following variables in the process:
 - Manipulated Variable
 - Controlled Variable
 - Measured Variable
 - Disturbances
 - Process Constraints
 - Keeping “control objective” as to maintain reactor temperature T at designated set-points. Design the following control loops:
 - Cascade Control
 - Feedforward control

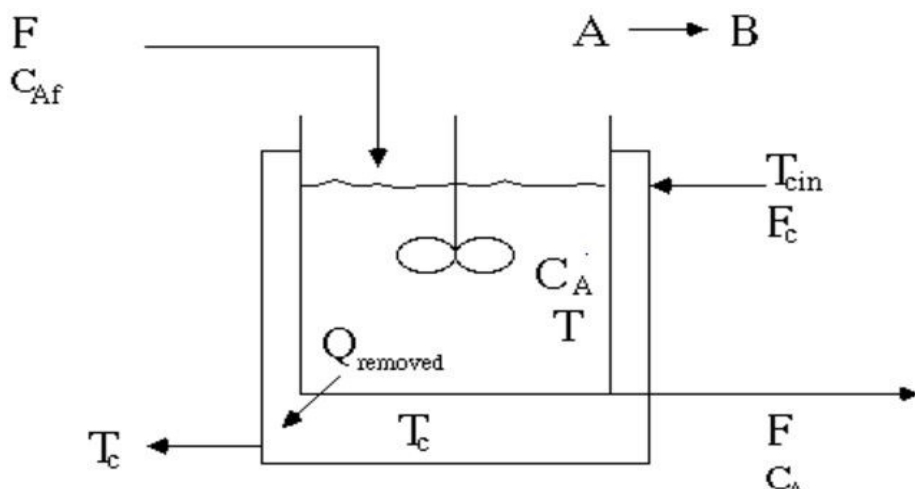


Figure 2 Q9 – Jacketed CSTR

20 CO4

- Q 10 Estimate the interaction (a) one loop closed and (b) both loops closed, between the controlled outputs and manipulated variable for a MIMO system as shown in

20 CO4

figure 3.



Figure 3 Q10 – MIMO process

OR

Attempt the following questions:

- a. Design an “**Auctioneering**” control system for the following temperature control application. [5 marks]

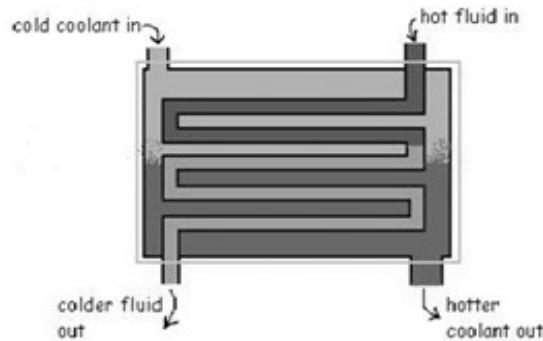


Figure 4 Q10 – Temperature control

- b. Design an “**Override control**” for the following process. Identify the controlled, measured, and disturbance variables. Also design a “**feedback**” controller for the same. The control objective is to maintain the temperature of the heated stream coming out of heat exchanger at a desired set-point. For this purpose superheated steam is fed though tube. [15 marks]

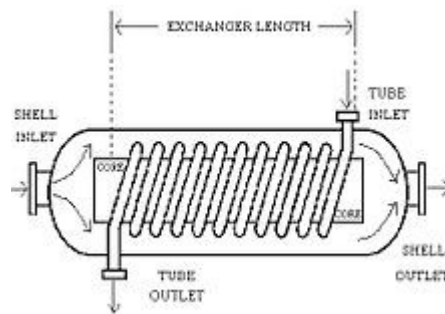


Figure 5 Q10 – Heat exchanger