

III B.Tech. I Semester Supplementary Examinations, May -2005

PROCESS CONTROL
(Electronics & Control Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is a mathematical model of process? Why it is required?
(b) Define degrees of freedom and explain with an example.
2. (a) What is integral wind up? Explain.
(b) How to convert a proportional controller into an ON – OFF Controller.
(c) Can derivative controller be used alone? Justify.
3. (a) Explain the operation of any one method of electrical transmission with closed loop. What are the advantages of electrical transmission?
(b) Write short notes on Electromagnetic flow meter.
4. (a) Explain the principle of operation of hydraulic PI controller.
(b) Explain the operation electronic PD controller.
5. (a) How would you determine the type of process that would require a cascade control and the type that require feed forward control?
(b) What are basic differences between the cascade and feed forward control.
6. (a) Explain mass transfer operations.
(b) Write about fuel and air flow ratio control in combustion system.
7. Discuss the controlling of reactant flows with suitable examples, when the reactants and products are immiscible.
8. What is inferential control? Explain how it is used in controlling the rate of drying.

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1. (a) Define degrees of freedom. Obtain the degrees of freedom of a liquid-to-liquid heat exchanger.
(b) Explain the self- regulation process with an example.
2. (a) A controller has the function

$$m = 1/T^2 \frac{d^2 e}{dt^2} + M$$
 Prove that the phase of the output lags 180 degrees behind the input.
 (b) Write the advantages and disadvantages of P controller.
3. (a) Explain the principle of operation of a differential pressure cell and explain how it can be used to measure level.
(b) Explain about any two non – contact type of flow measurement.
4. (a) Describe the electrical proportional controller with neat sketches.
(b) Calculate the input – output relationship and state the kind of control action.as shown in the below figure 1

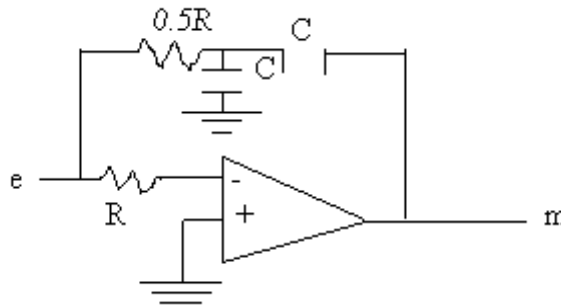


Figure 1:

5. (a) With a specific example, explain how feed forward controller improves the performance of a conventional feedback control.
(b) What is Ratio control system? Discuss such a control system with a specific process.
6. Draw simple schematic of heat exchanger and explain the control. How bypassing the heat exchanger improves dynamic response.
7. (a) Discuss the stability of exothermic reactors.

- (b) Write about the stability of endothermic reactors.
8. Write about boiling liquids and condensing vapors with its mass transfer equations.

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1. Write a short notes on
 - (a) Self- regulation
 - (b) Batch and Continuous Process
 - (c) Degrees of freedom
 - (d) Regulatory and servo problem
2.
 - (a) Why PID Controllers are preferred?
 - (b) An integral controller is used for speed control with a set point of 12 rpm within a range of 10 to 15 rpm. The controller output is 22% initially. The Constant $K_I = -0.15\%$. Controller output per second per percentage error. If the speed jumps to 13.5 rpm . Calculate the controller output after 2-sec.for constant error.
3.
 - (a) Explain the operation of any one method of electrical transmission with closed loop. What are the advantages of electrical transmission?
 - (b) Write short notes on Electromagnetic flow meter.
4.
 - (a) Briefly explain the working of force type of pneumatic PD controller.
 - (b) Explain the method of realizing an electronic PI controller employing delayed positive feedback. Derive the expression for proportional gain and integral time.
5.
 - (a) Draw a neat figure of pneumatic actuator with a positioner and explain. List its advantages.
 - (b) Write a short notes on control valve sizing.
6. Draw simple schematic of heat exchanger and explain the control. How bypassing the heat exchanger improves dynamic response.
7. What are the different factors can be considered to improve conversion in the chemical reactors?
8. With suitable diagrams explain the operations involved in nuclear power plant.

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1. (a) Obtain the transfer function for any level system.
(b) Explain the terms controlled variables, manipulated variables, input and output variables.
2. (a) What is integral wind up? Explain.
(b) How to convert a proportional controller into an ON – OFF Controller.
(c) Can derivative controller be used alone? Justify.
3. Briefly explain the few fluid flow measuring instruments.
4. (a) Explain in detail with neat sketches, the working principle of a pneumatic PID controller.
(b) Explain in detail with a neat sketch, the working principle of a hydraulic derivative controller.
5. (a) Explain about the operation of relay type actuator.
(b) Discuss about sliding drum control valves.
6. Explain about boiling liquids and condensing vapors briefly with necessary mathematical equations.
7. Discuss the use of feed forward control for steam flow in an evaporator.
8. What is multiple effect evaporation? Explain it.
