

III B.Tech. I Semester Regular Examinations, November -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. [8+8]
2. (a) Draw the o/p of the
 - i. three position controller
 - ii. single speed floating controller for the following error. Assume the relevant settings, as shown in the below figure 1

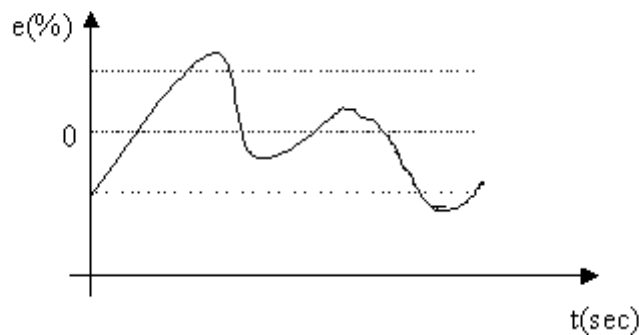


Figure 1:

- (b) Write the differences between PI and PID controllers. [8+8]
3. Write a short notes on
 - (a) Liquid – in – glass thermometers
 - (b) Pressure thermometers
 - (c) Peltier effect and Seebeck effect
 - (d) Hall effect. [4+4+4+4]
4. How are proportional and integral actions realized in a pneumatic controller? Obtain the transfer function of such a controller. How do you adjust the integrating time of a PI Pneumatic controller? [16]
5. Write a short notes on: [16]
 - (a) Globe valves
 - (b) Ball valves

- (c) Butterfly valves
6. (a) Write short notes on heat exchangers.
(b) Implement control system for boiler drum level control. [8+8]
7. Discuss the controlling of reactant flows with suitable examples, when the reactants and products are immiscible. [16]
8. With suitable diagrams explain the operations involved in nuclear power plant.[16]

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1. Obtain the mathematical model of a continuous stirred tank reactor. [16]
2. (a) A controller has the function
$$m = 1/T^2 \frac{d^2 t}{dt^2} + M$$

Prove that the phase of the output lags 180 degrees behind the input.
(b) Write the advantages and disadvantages of P controller. [8+8]
3. With a suitable example derive the step response of a first order and second order instrument and define the various terms related to it. [16]
4. (a) Explain the principle of operation of a displacement type pneumatic proportional controller.
(b) Outline the design steps involved in the implementation of an electronic controller and explain. [8+8]
5. Explain Feed forward and Ratio control with appropriate examples? [16]
6. (a) How can you measure the steam flow rate in boiler? Give mathematical equation.
(b) Discuss about control of fuel and air in combustion control. [8+8]
7. Discuss the controllability and conversion rate in plug flow and back mixed reactors. [16]
8. What is multiple effect evaporation? Explain it. [16]

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1. (a) What are process variable? And explain their functions with an example.
(b) Derive the mathematical model for any thermal system. [8+8]
2. (a) Discuss about the selection of controller for various Processes.
(b) Discuss about two – position control and single – speed-floating control. [8+8]
3. (a) Explain about the design of a air supply system for pneumatic instruments?
(b) Compare pneumatic transmission with electric transmission. [8+8]
4. How are proportional and integral actions realized in a pneumatic controller? Obtain the transfer function of such a controller. How do you adjust the integrating time of a PI Pneumatic controller? [16]
5. (a) What are the fundamental characteristics of a cascade controller?
(b) Explain the basic principle of cascade control with one industrial application. [8+8]
6. Write briefly about boiler steam pressure ,drum level control Systems and super heat steam temperature control. [16]
7. What are the different factors can be considered to improve conversion in the chemical reactors? [16]
8. What is inferential control? Explain how it is used in controlling the rate of drying. [16]

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1. (a) Give a process equation for any temperature type of process.
 (b) Explain what is meant by process load and process lag.
 (c) Compare the regulatory and servo operations. [8+4+4]

2. (a) What is the purpose of Ziegler - Nicholas method and for what type of process, this method is applicable? Consider a fourth – order process with open loop transfer frequency of a unity feedback system is given by

$$G(S) = \frac{1}{(S+2)(S+4)(S^2+6S+25)}$$
 Find the controller settings for PID controller.
 (b) Write a short notes on ON- OFF Controller. [8+8]

3. A step change of magnitude 4 is introduced into a system having the transfer function of

$$\frac{X(S)}{Y(S)} = \frac{10}{S^2+1.6S+4}$$
 Determine
 (a) Percentage of over shoot
 (b) Rise time
 (c) Maximum value of y(t)
 (d) Ultimate value of y(t)
 (e) Period of oscillations. [16]

4. (a) Compare displacement and force balance type of pneumatic controllers.
 (b) Explain the principle of operation of electrical proportional controller. [8+8]

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. [10+6]

6. (a) Discuss about the super heat steam temperature control.
 (b) Explain about the direct mixing heat exchange between two fluids with necessary mathematical explanation. [8+8]

7. Write short notes on the following.
 (a) Apportioning reactant flows.

(b) Maximizing production.

[8+8]

8. Explain the relative gain analysis with one example.

[16]
