R07

Set No. 2

[8+8]

III B.Tech I Semester Examinations,May 2011 PROCESS CONTROL INSTURMENTATION Common to Chemical Engineering, Instrumentation And Control Engineering, Electronics And Instrumentation Engineering Time: 3 hours Max Marks: 80 Answer any FIVE Questions

All Questions carry equal marks

- 1. (a) Explain the principle of operation of proportional control action.
 - (b) Explain how off set error in proportional controller occurs with an example.
- 2. (a) What is control valve? Discuss about operation of Butterfly valve. Where is this valve used?
 - (b) What is the significance of control valve sizing? Discuss about various steps involved in selecting control valve size. [8+8]
- 3. (a) Explain with a neat sketch, the realization of pneumatic proportional controller.
 - (b) Derive the expression for the output voltage of an electronic P+I+D controller with a neat sketch. [8+8]
- 4. (a) Explain how controller settings for minimum error integral are obtained?
 - (b) Determine the effective system parameters from the following transient response, and predict the critical frequency and maximum gain $K_C = 0.6 \ K_C \ max$, $T_R = P_4/2.0$; $T_0 = P_V/8$ [8+8]
- 5. (a) Explain the importance of current to pressure signal conversion in process industries with examples.
 - (b) Explain the importance of pressure to current signal conversion in process industries with examples. [8+8]
- 6. (a) Is mercury thermometer a first order system? Derive the expression for transfer function.
 - (b) How the system behaves with a step change of temperature? Explain the dynamics. [8+8]
- 7. An open loop transient test provides the process reaction as shown in figure 1, for a 7.5% disturbance.
 - (a) Find the standard proportional, integral gain settings.
 - (b) Find the three mode quarter amplitude settings. [16]



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Set No. 4

III B.Tech I Semester Examinations,May 2011 PROCESS CONTROL INSTURMENTATION Common to Chemical Engineering, Instrumentation And Control Engineering, Electronics And Instrumentation Engineering Time: 3 hours Max Marks: 80 Answer any FIVE Questions

All Questions carry equal marks

- 1. (a) Discuss relative advantages and disadvantages of proportional, integral and derivative actions.
 - (b) Discuss the effect of proportional control action on the closed loop response of process. [8+8]
- 2. (a) Explain with a neat sketch, the realization of a hydraulic proportional controller.
 - (b) Derive the expression for output voltage of an electronic derivative controller with a neat sketch. [8+8]

3. Discuss the tuning of controllers using

- (a) Continuous oscillation method.
- (b) Damped oscillation method. [8+8]
- 4. (a) What is an actuator? What is the role of actuator in the final control operation of a process control system?
 - (b) Mention different types of actuators used in process industries. [8+8]
- 5. (a) Explain the principle of control valve and give its output equation.
 - (b) Explain with a neat diagram of double seated valve. [8+8]
- 6. Discuss the rational of cascade control and demonstrate why it provides better performance than feedback control. [16]
- 7. (a) List the different simple performance criteria and explain each.
 - (b) A unit feedback system has the forward path transfer function $G(s) = \frac{K}{S(S+a)}$. Determine the value of 'a' which minimizes the ISE by taking K as constant. [8+8]
- 8. (a) Describe the dynamics of a flow process with an example.
 - (b) Draw a pressure process system of non-interacting type and derive the transfer function. [6+10]

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Set No. 1

III B.Tech I Semester Examinations,May 2011 PROCESS CONTROL INSTURMENTATION Common to Chemical Engineering, Instrumentation And Control Engineering, Electronics And Instrumentation Engineering Time: 3 hours Answer any FIVE Questions

All Questions carry equal marks

- 1. (a) Differentiate pneumatic and hydraulic actuators.
 - (b) Mention the merits and demerits of pneumatic and hydraulic actuators. [8+8]
- 2. (a) Define proportional band? Explain the relation between proportional gain, proportional band and off set error.
 - (b) With a neat sketch explain the proportional and integral control action. Summarize the characteristics. [8+8]
- 3. (a) What is control valve? List types of control valves. Discuss about any one type of valve in detail with a neat sketch.
 - (b) Elaborate on control valve sizing. What are various steps needed to select control valve size, Explain. [8+8]
- 4. (a) Explain the cascade control and give an example of the same when used in a distillation column.
 - (b) Write about feed forward control and give its advantages & disadvantages. [8+8]
- 5. (a) Explain with a neat sketch the realization of a pneumatic P+I+D controller.
 - (b) Implement a proportional + derivative controller with op-amps and derive the expression for output voltage. [8+8]
- 6. (a) Explain the servo and regulatory operations with suitable examples.
 - (b) Explain self & non-self regulatory systems with an example. [8+8]
- 7. (a) What is an optimal tuning control? What are its different approaches?
 - (b) Explain how "ITAE" is used in evaluation of performance of a process. [8+8]
- 8. (a) What is the value of the proportional gain Kc for a pure dead-time system according to the Cohen-Coon settings? Is it reasonable? Explain.
 - (b) Discuss the merits and demerits of optimum settings by trial and error method for PID controller. [8+8]

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Set No. 3

III B.Tech I Semester Examinations,May 2011 PROCESS CONTROL INSTURMENTATION Common to Chemical Engineering, Instrumentation And Control Engineering, Electronics And Instrumentation Engineering Time: 3 hours Answer any FIVE Questions

All Questions carry equal marks

- 1. Explain how a Pneumatic positioning actuator functions in both direct and reverse modes. [16]
- 2. (a) With aid of bellows and flapper nozzles implement a proportional + integral controller
 - (b) Discuss about hydraulic-integrator with a neat sketch. [8+8]
- 3. Explain the following methods of controllers tuning:
 - (a) Open-loop transient response method.
 - (b) Zeigler-Nichols method [8+8]
- 4. Differentiate between a continuous process and a batch process. Explain the above two with examples. [16]
- 5. A control valve operates from 3-15 PSI control signal. To have a 40gal/min flow rate express the signal input in both PSI and percent of range if,
 - (a) It is a linear valve from 0 to 90gal/min, and
 - (b) If it is an equal percentage valve with R=6 and $Q_{min}=15$ gal.min [8+8]
- 6. (a) List the different types of performance criterions and explain each.
 - (b) Design the integral controller for the given system by 1/4 decay ratio criterion. as shown in figure 2 [8+8]



Figure 2:

7. (a) Explain the characteristics of two position and three position control modes with neat sketches

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- (b) What is cycling? Suggest a suitable modification to over come cycling.[10+6]
- 8. (a) What is the effect of external feedback in cascade control system? Illustrate it with suitable example.
 - (b) Explain clearly about the tuning of cascade controllers with appropriate examples. [8+8]

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