Code No: 07A51004 **R07** **Set No. 2**

III B.Tech I Semester Examinations,November 2010
PROCESS CONTROL INSTURMENTATION
Common to Instrumentation And Control Engineering, Electronics And Instrumentation Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Write short notes on:
   (a) Cavitation.
   (b) Flashing. [8+8]
2. (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]
3. (a) Realize a hydraulic derivative controller with a neat sketch and explain the operation.
   (b) Draw the P+I+D electronic controller and derive the expressions for output voltage. [8+8]
4. (a) Explain, how a 4-20mA current signal converts into 3-15PSI pressure signal in process industries with neat diagram.
   (b) Mention the role of the above device in process industries. [10+6]
5. (a) What control strategy is needed for improved performance when input and output of a process is affected by significant disturbance?
   (b) What is compensation in a closed operation? Explain with neat diagram. [8+8]
6. (a) What are multi capacity systems? Give one example and explain why it is called so.
   (b) Write the differential equation for this system and determine the transfer function. [8+8]
7. (a) What is Optimum-tuning control? What are its different approaches?
   (b) How are the interactions in control being channelized to optimize the control action in a boiler? [8+8]
8. A unity feedback system has an open loop transfer function for the unit step input. Compute the ISE, ITSE. Calculate the optimal values for a>0 which minimizes ISE, ITSE.
   $G(s) = \frac{K}{S(S+2a)}$ [16]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A51004 **R07** **Set No. 4**

III B.Tech I Semester Examinations,November 2010
PROCESS CONTROL INSTURMENTATION
Common to 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) Draw a neat sketch of hydraulic amplifier and explain the operation.
   (b) A proportional pneumatic controller has equal area bellows. If 3 - 5 psi signals are used on input and output, find the ratio of P_1V/S distance that provide 25% proportional band. [8+8]
2. (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]
3. Discuss the tuning of controllers using:
   (a) Cohen-coon method
   (b) Zeigler-Nichols method. [8+8]
4. (a) Write short notes on valve positioners.
   (b) A springless actuator has a diaphragm of 100 sq.in. area, its position operates from 3 to 15 PSI. The cushion pressure is set to 5 PSI. What is the range of thrust loadthatcanbeaccommodated? [8+8]
5. (a) What are the different types of process variables?
   (b) Name all the variables of a liquid heating tank heated by electric current in a heater. [6+10]
6. (a) Discuss the effect of an integral control action on the closed loop response of first order process.
   (b) With a neat sketches, explain the principle of derivative control action. Summarize its characteristics. [8+8]
7. (a) When do you propose single loop control schemes? List the different tuning schemes of PID controllers.
   (b) Explain how decay ratio is used for evaluation of the performance of a process? [8+8]
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]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A51004 **R07** **Set No. 1**

III B.Tech I Semester Examinations,November 2010
PROCESS CONTROL INSTURMENTATION
Common to 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) With a neat diagram, explain the realization of an electronic two position controller with adjustable neutral zone.
   (b) List the advantages and disadvantages of pneumatic control systems. [10+6]
2. (a) Explain few control schemes in boiler system.
   (b) Explain the control schemes used in distillation column. [8+8]
3. Explain the following with neat diagrams:
   (a) Pneumatic booster.
   (b) Valve positioner. [8+8]
4. (a) Discuss the dynamics of thermal temperature process with an example.
   (b) Explain the single & multi capacity processes with an example. [8+8]
5. (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]
6. (a) Discuss the relative advantages and disadvantages of various controller modes.
   (b) A three mode controller has $K_P = 2.5$; $K_i = 2.5\ S^{-1}$; $K_d = 2$sec and $P_I = 30\%$. Plot the controller output as function of time for the following error. as shown in figure 1 [8+8]

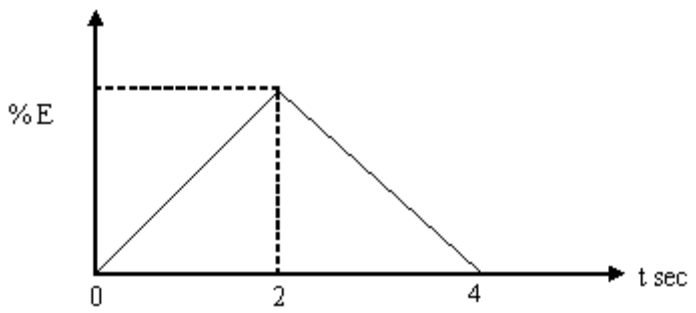

Figure 1:

Code No: 07A51004 **R07** **Set No. 1**

7. Find the proper valve coefficient, for pumping a liquid flow rate of 600gal/min with a maximum pressure difference of 55 PSI. The liquid specific gravity is 1.3. [16]

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]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A51004 **R07** **Set No. 3**

III B.Tech I Semester Examinations,November 2010
PROCESS CONTROL INSTURMENTATION
Common to 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 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]
2. In the Zeigler-Nichols method, the critical gain was found to be 4.2, and the critical period was 2.21 min. Find the standard settings for,
   (a) Proportional-mode control,
   (b) PI control, and
   (c) PID control. [4+6+6]
3. (a) Write the differential equations for the following level process and hence derive the transfer function of the system. as shown in figure 2

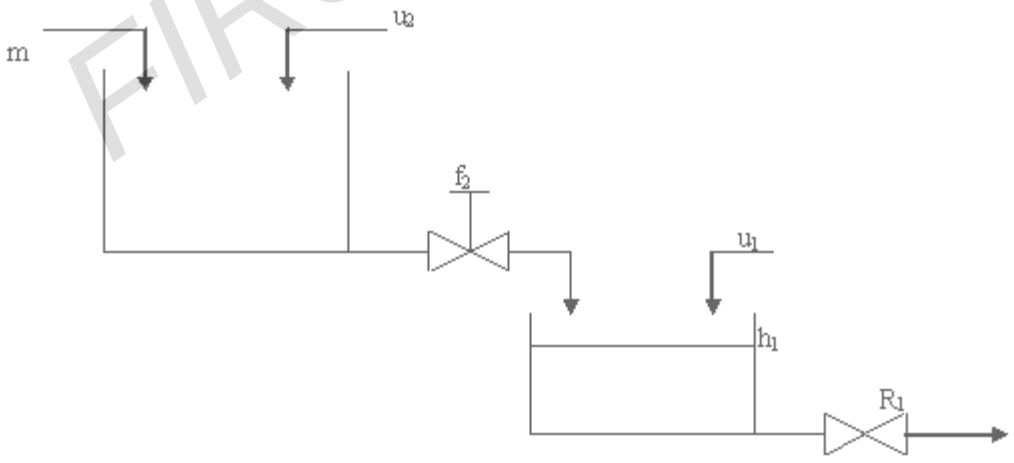

Figure 2:

   (b) Say whether the above systems is interacting or non interacting systems, give time constants. [12+4]
4. (a) Explain the method of boiler level control using cascade operation.
   (b) Explain the control of boiler level using feed forward operation. [8+8]

Code No: 07A51004 **R07** **Set No. 3**

5. (a) Write short notes on Hydraulic actuators.
   (b) A hydraulic system uses a working piston of radius 6cm and forcing piston of radius 1cm.
      i. Find the working force resulting from 200N applied force
      ii. Find the hydraulic pressure. [8+8]

6. (a) What is anticipatory control action? Describe with an equation. Summerize the characteristics.
   (b) A PD controller has $K_P = 2.0$; $K_D = 2$sec; $P_O = 40\%$. Plot the controller output for the following as shown in figure 3 input. [8+8]

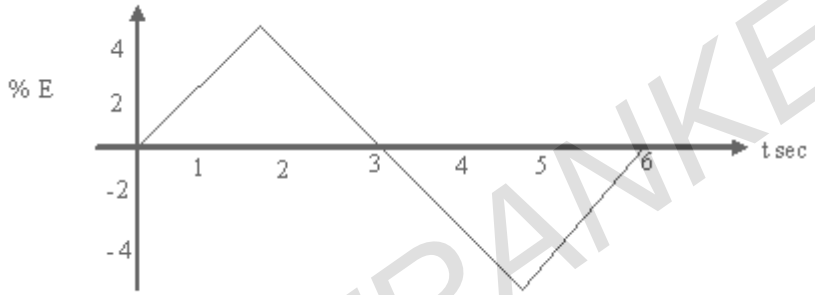

Figure 3:

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 valve discharges from a tank with a head of 20ft. of water to a tank with a head of 10ft. and maximum flow rate is 100gpm. what should be the size of the valve? [16]

⋆ ⋆ ⋆ ⋆ ⋆