B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2009)

Fifth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

EIE106: Process Control

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1.   The term K_P in the transfer function of a first order process is called as _____.

   a)   Integral Gain
   b)   Steady State Gain

   c)   Proportional gain
   d)   Derivative Gain

2.   The sluggishness or delay expressed in the step response of two or more first order systems connected in series is called as _____.

   a)   Transfer Lag
   b)   Transportation lag

   c)   Dead Time
   d)   Pure delay

3.   _____ Control action eliminates any offset.

   a)   Proportional
   b)   Derivative

   c)   Integral
   d)   On/Off

4.   In analog electronic controller for the Integral Mode, Integration Gain G_I is given by _____.

   a)   RC
   b)   1/RC

   c)   R/C
   d)   C/R

5.   The Valve Positioner will act as a _____.

   a)   PID controller
   b)   PI controller

   c)   High gain proportional controller
   d)   PD controller

6.   To specify the size of a valve in terms of its capacity to provide flow when fully open, the equation used is _____.

   a) $q = \sqrt{\dfrac{\Delta p_v}{G}}$
   b) $q = \sqrt{\dfrac{G}{\Delta p_v}}$

   c) $q = \sqrt{\dfrac{G \Delta p_v}{Q}}$
   d) $q = \sqrt{\dfrac{Q \Delta p_v}{G}}$

7. ITAE suppress Errors that _____.

    a) Persist for long duration   b) persist for short duration

    c) Small value of error less than 1   d) Large value of error

8. gler-Nichols method of tuning controller parameter, the ultimate period of sustained cillation "P_U" is given by _____.

    a) $\dfrac{2\pi}{\omega_{co}}$ b) $2\pi\omega_{co}$

    c) $\dfrac{\omega_{co}}{2\pi}$ d) $\pi\omega_{co}$

9. _____ belongs to adaptive control strategy.

    a) Gain scheduling control   b) Auctioneering control

    c) Override control   d) Split range control

10. Inferential control is employed when _____.

    a) Controlled variable cannot be measured directly   b) Control configuration has one measurement and more than one manipulated variable

    c) Control configuration has more than one measurement and one manipulated variable   d) The process parameters are varying

PART B (10 x 2 = 20 Marks)

11. Define self regulation with an example.
12. Differentiate between lumped and distributed parameter models with examples.
13. Write the limitations of ON/OFF control mode?
14. Mention the characteristics of Integral mode of controller.
15. What is meant by actuators? List the different types of actuators.
16. Mention the difference between the direct acting and reverse acting control valve.
17. What is ISE and when to go for it?
18. List the different methods of Controller Tuning.
19. Mention the different chemical processes that employ ratio control.
20. Draw the P &ID symbol for Orifice plate.

PART C (5 x 14 = 70 Marks)

21. a) (i) What is Servo and Regulatory Operations? (4)

      (ii) A tank system having a time constant of 0.5 min and a resistance of 0.25 min/m2 (10) is operating at steady state with an inlet flow of 2m³/min. The flow is suddenly increased to 3m³/min. Plot the response of the tank level.(Assume area of cross section A=2m²)

(OR)

   b) (i) Explain the term degree of freedom of a Process. (4)

      (ii) Obtain the transfer function $\dfrac{h_2(s)}{q_1(s)}$ for the interacting tank system? (10)

22. a) (i) What is reset windup? How to overcome this? (4)

      (ii) Design a proportional – integral controller with a proportional band of 30% and (10) an integration gain of 0.1% / (%-Sec). The 4-20mA input converts to a 0.4-2 volt signal, and the output is to be 0-10 volts. Calculate the values of G_P, G_I, R_2, R_1, and C respectively.

(OR)

   b) (i) Why derivative control is not recommended alone for any process? (4)

      (ii) A temperature control system inputs the controlled variable as a range from 0 to (10) 4V. The output is a heater requiring 0 to 8V. A PID controller is to be used with $K_p = 2.4\% / \%, K_I = 9\% /(\% - \min), K_D = 0.7\% /(\% / \min).$ The period of the fastest expected change is estimated to be 8 sec. Develop the PID circuit.

23. a) (i) Discuss the working of a control valve with Positioner. (7)

      (ii) Explain in detail about the flapper nozzle arrangements with necessary diagram. (7)

(OR)

   b) (i) Discuss in detail the flow-lift characteristics of control valve of necessary (7) diagrams.

      (ii) A valve with a C_v rating of 4.0 is used to throttle the flow of glycerin for which (7) G=1.26. Determine the maximum flow through the valve for a pressure drop of 100 psi.

24. a) (i) Mention the commonly used time integral performance criteria with its Representation. (4)

       (ii) Discuss in detail about the various steps involved in the process reaction curve method of controller tuning. Also tabulate the expressions for the "best" controller settings developed by Cohen & Coon. (10)

(OR)

   b) (i) Write a brief note on ¼ decay ratio method of controller tuning. (4)

       (ii) Explain the various steps involved in tuning the controller by Continuous cycling method with necessary diagrams. (10)

25. a) (i) Draw the feed forward control configuration for the application of drum level Control in a boiler and explain. (7)

       (ii) Explain the cascade control scheme with a neat sketch. (7)

(OR)

   b) (i) What is split- range control? Discuss a situation where you could use split range Control. (7)

       (ii) Describe any one adaptive control scheme with necessary diagram. (7)

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