2011

PROCESS CONTROL ENGINEERING

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The function of reset action in a process controller is to

a) reduce rise time

b) reduce steady state error

c) reduce oscillation in the response

d) increase overall gain.

ii) The basic limitation of *P* action controller only is

a) Very slow error correction

b) High overshoot

c) Non-zero offset

d) Instability of process.

iii) For 100% error to the proportional controller, its o/p is 50%. The PB is

a) 200% b) 100%

c) 50% d) 150%.

iv) C-C controller tuning technique is used for

a) Open loop system b) Closed loop system

c) Both of these d) None of these.

v) If K_p and T_d denote the proportional gain and the derivative time constant respectively of a PD controller then the rate time τ_d is denoted by

a) K_p/T_d b) T_d/K_p

c) $K_p T_d$ d) $1/K_p T$.

vi) The type of isolator generally used in I/O module of PLC is

a) electrical b) electronics

c) magnetic d) optical.

vii) The proportional sensititivity is maximum in

a) P controller b) I controller

c) PD controller d) PID controller.

viii) PLC supports

a) C programming b) Java programming

c) Ladder programming d) VB programming.

ix) Which type of networking connectivity is generally supported by DCS ?

a) LAN b) MAN

c) WAN d) None of these.

x) An example of an Industrial Control System is

a) PLC b) DCS

c) PLC & DCS d) None of these.

xi) DDC is a type of which control scheme ?

a) Analog control b) multi variable

c) ratio control d) feed forward control.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is reset action ? Prove that P.B = $100/K_c$, where symbols have their usual meaning. 1 + 4

3. Explain the ON-OFF controller characteristics without differential gap and with differential gap. Write their advantage and disadvantage. 3 + 2

4. What is pneumatic controller ? Describe with proper diagram the function of pneumatic relay in a pneumatic controller. 1 + 4

5. What do you mean by "Process Reaction Curve" ? How is it obtained for a particular process ? How the time constant of a first order process can be determined from the process reaction curve ? 1 + 1 + 3

6. What is gateway connectivity in DCS ? Describe the generic gateway in DCS. 1 + 4

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. What is process resistance and process capacitance ? Discuss pneumatic P-I and P-D controller with a schematic diagram. Explain an electronic PD controller and derive its control equation from its circuit diagram. 2 + 8 + 5

8. What do you mean by tuning of controller ? What are the basic criteria of tuning of controller ? Explain the open loop tuning technique of Cohen-Coon. What are the basic criteria of Ziegler-Nichols tuning method ? What is $^1/_4$ decay ratio ?

2 + 3 + 5 + 2 + 3

9. What is PLC ? What are the advantages of PLC control system ? What are different data files available in PLC ? What is the function of I/O module in a PLC ? Describe the basic functional blocks of a PLC with suitable diagram.

2 + 3 + 2 + 3 + 5

10. What is the necessity of control valve sizing ? What are the factors that should be known for selecting a valve ? A control valve regulates the liquid flow of a tank. The water level is controlled in the tank at a 50 feet by regulating the outflow. The measured inflow varies from 0 to 140 gallons per minute. Calculate C_v for the valve. What is valve cavitation ? What are the conditions to avoid cavitation ? 2 + 3 + 5 + 2 + 3

11. Write short notes on any *three* of the following : 3×5

    a) Pneumatic actuator.

    b) DDC.

    c) PID controller.

    d) DCS.

    e) Boiler drum level control.