Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS / B.TECH (ICE) / SEM-6 / IC-601 / 2011

2011

PROCESS CONTROL

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) In feedback control

a) corrections are carried out before the disturbances affect the output

b) corrections are being carried out after the effect of disturbance is felt by the controlled variable

c) corrections are carried out at any time

d) none of these.

ii) First order systems have

a) static sensitivity as characterizing parameter

b) static sensitivity & time constant as characterizing parameters

c) static sensitivity & damping factor as characterizing parameters

d) static sensitivity & natural frequency as characterizing parameters.

iii) For a proportional controller

a) increase in proportional gain reduces offset but increases oscillations

b) increase in proportional gain increases offset

c) decrease in proportional gain reduces offset but increases oscillations

d) decrease in proportional gain increases offset but reduces oscillations.

iv) Controller tuning refers to

a) best adjustment of controller parameters

b) best adjustment of steady state characteristics

c) best adjustment of response time

d) best adjustment of dynamic characteristics.

v) The offset current & offset voltage of an ideal Op-Amp are

a) 0, 0 b) 20 nA & 2 mV

c) α , α d) 20 mA & 2 mV.

vi) Ratio control is a

a) special type of feedback control

b) special type of feed forward control

c) special type of digital control

d) special type of cascade control.

vii) In a self regulating process

a) controlled variable is adopted for a nominal load with no control action

b) controlled variable is adopted with control action

c) there is a tendency to overshoot

d) there is a tendency to be unstable.

viii) A system with dead time element, has

a) output in the same form as input with some delay

b) output in the different form as input with some delay

c) output in the same form as input without a delay

d) none of these.

ix) For an integral process

a) output will continue to increase until limits of the system are reached

b) output will continue to decrease until limits of the system are reached

c) output will continue to increase irrespective of limit

d) output will remain constant.

x) The objective of servo control is

a) elimination of disturbances

b) to make the controlled variable to follow the changes in set point

c) to make the controlled variable to follow the output

d) none of these.

xi) Error resulting from the step change in set point is termed as

a) static error b) offset error

c) dynamic error d) disturbance.

xii) Salient features of cascade control system are

a) more than one measurement but one manipulated variable

b) one measurement but multiple manipulated variable

c) two feedback loops are nested together

d) both (a) and (c).

GROUP – B

(Short Answer Type Questions)

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

2. Differentiate between feedback & feed forward operations with the help of an example.

3. What is meant by self regulating system ? Explain. Give an example of self regulating system in hydraulic systems.

4. How is time proportional controller different from on-off controller ? Explain.

5. a) What is meant by controller tuning ?

   b) Define static error, offset error and velocity error.

6. Compare pneumatic controllers with hydraulic controllers in terms of speed, power output, safety & effect of temperature variation.

GROUP – C

(Long Answer Type Questions)

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

7. a) Explain the principles of operation of P, PI & PID controllers. Mention their positive & negative features.

   b) The transfer function of a 3-tank system in $G_p(s) = \dfrac{6}{(2s+1)(4s+1)(6s+1)}$.

   The system is under proportional control. Find the value of K_p for which the closed loop system remain stable.

   10 + 5

8. a) What are the advantages of cascade control configuration ?

   b) Explain 'end point control' configuration of ratio control with the help of an example.

   c) The temperature of a furnace is to be controlled. The rate of flow of fuel to the furnace is manipulated variable. Pressure of the fuel is the secondary variable. Draw a cascade control scheme for this system.

   4 + 5 + 6

9. a) How does Schmitt trigger help in reducing the effect of noise on switching in a process control system ?

   b) How are P & I actions are realized in a pneumatic controller ? How are these actions varied in magnitude ? Obtain the transfer function of such a controller. 5 + 10

10. a) What is the C_v factor of a control valve ? How is it useful in valve selection & sizing ?

    b) When are single seated & double seated valves used ? List & compare their advantages & disadvantages.

    c) What is the difference between safety valve & relief valve ? 6 + 6 + 3

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

    a) Dead time compensation

    b) Interacting & non-interacting processes

    c) Relation control

    d) Load disturbances and its effects.

==========