Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/(ICE-Old)/SEM-6/IC-601/2013

2013

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 × 1 = 10

   i) For frequency domain analysis of any system ..... is applied.

   a) step input b) ramp input

   c) sinusoidal input d) impulse input.

   ii) ON-OFF control system is recommended where

   a) PRR is low and DSC is high

   b) PRR is low and DSC is low

   c) PRR is high and DSC is low

   d) PRR is high and DSC is also high

   where PRR : Process Reaction Rate &

   DSC : Demand side capacity.

iii) A proportional contoller can be act as an on-off controller when

a) K_p is zero b) PB is infinity

c) K_p tends to infinity d) K_p is 0.5.

iv) Which of the following is nown as rate control ?

a) Proportional control b) Integral control

c) Derivative control d) Multi step control.

v) 3C method of controller tuning was recommended by

a) Bode b) Ziegler & Nichols

c) Cohen & Coon d) Routh.

vi) Integral action reduces

a) peak overshoot b) offset

c) settling time d) rising time.

vii) For a non-self-regulating process the damping co-efficient ξ will be

a) 1 b) > 1

c) < 0 d) > 0 but < 1.

viii) In a proportional controller if proportional gain is 2, then proportional band is

a) 50% b) 2%

c) 200% d) 500.

ix) The order of two non-interacting tank level system is

a) first b) second

c) third d) zero.

x) in which control system input is measured and manipulated ?

a) Feedback b) Open loop

c) Feed-forward d) Close loop.

xi) The example of ratio control in boiler is

a) Combustion control

b) Drum level control

c) Master steam pressure control

d) Furnace pressure control.

xii) The maximum phase change observed in a first order system when sinusoidal input is applied

a) 0° b) 90°

c) 180° d) – 90°.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. How the controllability of a process can be assessed from process reaction curve ?

3. How three position controllers improve control accuracy over two position controllers ?

4. What is meant by a self-regulating process ? Explain with an example. Draw the output response of a self-regulating process when unit step disturbance is applied to the process. 2 + 2 + 1

5. When tuning a three mode controller by ultimate cycle method it was found that oscillation begin when the proportional band decreased to 30%. The oscillation has a periodic time of 500s. What are the suitable values of proportional gain, integral gain and derivative gain ?

6. What is the function of an actuator ? Give a labelled sketch of a pneumatic actuator. 2 + 3

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Define manipulated variables and disturbances with example. Derive the transfer function of a mixing process involving energy balance. Calculate the time constant and steady state gain. 4 + 10 + 1

8. What is offset ? Explain how offset is created in a process. Calculate the value of offset in a process. How the offset will be reduced ? 1 + 3 + 9 + 2

9. Define Cv. Why control valve sizing is required ? Discuss the methodology of control valve sizing. 2 + 5 + 8

10. What is ratio control system ? Draw the block diagram of such system. Explain this control scheme with a suitable example. 3 + 4 + 8

11. Discuss pneumatic "PD" controller with a schematic. What is reset wind up ? A derivative controller has a set point of 50% and derivative constant K_D of 0.4% s/%. What will be the controller output when the error (i) change at 1%/sec and (ii) is constant at 4%. 7 + 3 + 5