Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/EIE (NEW)/SEM-6/EI-601/2013

2013

PROCESS CONTROL – I

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) Brain of the process control loop is

      a) a controller

      b) actuator

      c) valve

      d) all of these.

   ii) Ratio control system is a special type of

      a) open loop control system

      b) ON-OFF control system

      c) feed forward control system

      d) feedback control system.

iii) Controller output for a time-proportional control action is

a) proportional to the time

b) continuous in nature

c) discrete in nature

d) none of these.

iv) What type controller is used for elimination for offset ?

a) P-controller

b) I-controller

c) D-controller

d) time-proportional controller.

v) A cascade controller is used when the process

a) gain is too small

b) gain is too large

c) has widely different two time constants

d) oscillation of the output is not permitted.

vi) Ziegler-Nichols tuning technique is a/an

a) open loop procedure

b) closed loop procedure

c) semi-open loop procedure

d) semi-closed loop procedure.

vii) D-control action is realized using

a) Ramp signal b) Step signal

c) Sinusoidal signal d) both (a) & (c).

viii) Which valve is used for pressure control ?

a) Globe valve b) Butterfly valve

c) Check valve d) None of these.

ix) Response of feed forward control is ..... than feedback control.

a) moderate b) faster

c) slower d) none of these.

x) Valve-positioner is a high gain

a) P-controller b) D-controller

c) PI-controller d) I-controller.

xi) Which type of isolator is generally used in I/O module of PLC ?

a) Electrical isolator

b) Optical isolator

c) Magnetic isolator

d) Electronic isolator.

GROUP – B

(Short Answer Type Questions)

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

2. What is a servo loop ? Explain it with a proper diagram. How does it differ from a process control loop ? 1 + 3 + 1

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

4. Draw the block diagram of a basic process control loop and describe the function of each block in brief.

5. Explain with a neat sketch how feed forward control is implemented for the temperature control in a heat exchanger system.

6. What do you mean by double seated valve ? Why is it advantageous over single seated valve ? 3 + 2

GROUP – C

(Long Answer Type Questions)

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

7. a) What is the major problem of proportional controller when set point is changed ?

   b) Why is derivative control not used alone ?

c) Explain the principle of operation of On-Off controller. Explain the function of differential gap or neutral zone on the performance of On-Off controller.

d) Discuss analytically the problem for the proportional controller in a first order process.

e) Explain analytically how the problem can be eliminated using the proportional integral (PI) controller.

1 + 2 + 2 + 2 + 4 + 4

8. a) Draw the block diagram of PLC and explain briefly the principle of operation.

b) What are the differences between retentive and non-retentive timer of PLC ?

c) A selection committee comprises four members including the chairman. In order for a candidate to be selected, he or she has to have the support of at least 2 members. The chairman, however, can push any candidate though. If each member is provided with a switch, determine a logic that will ring a bell when a candidate is selected & draw the ladder diagram for this.

5 + 4 + 6

9. a) Explain the operating principle of a pneumatic actuator with suitable diagram.

b) Draw and explain the equal percentage valve characteristics.

c) Draw and explain the operation of a spring actuator valve with positioner.

d) A 1·5 inch control valve has the linear characteristics with the following specifications :

At 30% valve opening, $C_V = 9 \cdot 6$

At 40% valve opening, $C_V = 13 \cdot 3$

At 80% valve opening, $C_V = 25 \cdot 9$

Calculate C_V at 90% valve opening. 3 + 2 + 5 + 5

10. a) What are the different tuning schemes proposed for a PID controller ? How have they been evolved ?

b) How can the controllability of a process assessed from the process reaction curves ? 10 + 5

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

a) Solenoid valve

b) Cascade control

c) Safety valve

d) I/P converter

e) Override control.