Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(EIE-NEW)/SEM-6/EI-601/2011

2011

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) Proportional controller is characterised by
   a) proportional gain
   b) proportional band
   c) production of offset
   d) all (a), (b) & (c).

ii) Process dynamics refers to
   a) time varying behaviour of processes
   b) static behaviour of processes
   c) discrete behaviour of processes
   d) impulse behaviour of processes.

iii) 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.

iv) Flapper-nozzle system uses
   a) hydraulic relay b) pneumatic relay
   c) electrical relay d) mechanical relay.

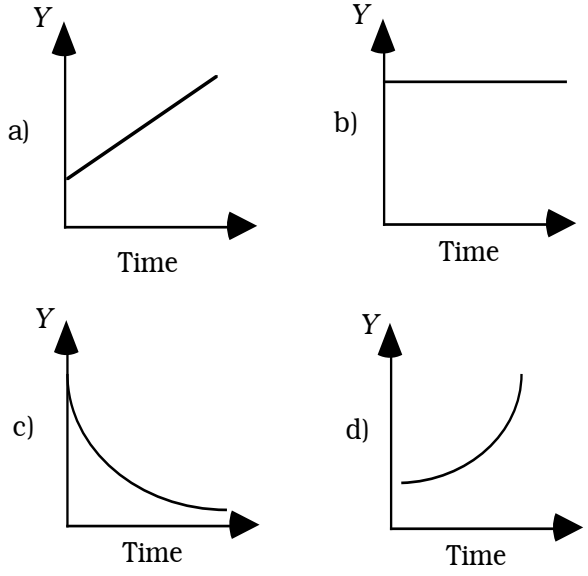
v) Schmitt trigger configuration of op-amp uses
   a) positive feedback b) negative feedback
   c) (a) or (b) d) no feedback.

vi) Ratio control is a
   a) feed forward control b) cascade control
   c) multivariable control d) both (a) & (c).

vii) Process reaction curve method developed by Cohen & Coon is a
   a) closed loop method
   b) open loop method
   c) (a) or (b)
   d) semi-closed loop method.

viii) Introduction of integral action
   a) increases the order of the system
   b) decreases the order of the system
   c) has no effect on the order of the system
   d) reduces the stabilization time.

ix) Response of PI controller for step input is



x) In mathematical models, for linearizing nonlinear tersm
   a) exponential series expansion is used
   b) Taylor series expansion is used
   c) sinusoidal series expansion is used
   d) log series expansion is used.

xi) Example of self-regulating system is
   a) thermal system
   b) chemical reactor
   c) liquid level control system
   d) none of these.

xii) Distributed parameter systems are described by
   a) PDE b) ODE
   c) Difference equation d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Differentiate between servo & regulator operations with the help of an example.
3. Obtain the expression for the transfer function of a tubular reactor.
4. How is time proportional controller different from on-off controller ?
5. What do you mean by self-regulation of a process ?
6. How are *P* & *I* actions are relalized in a pneumatic controller ?

GROUP – C

(Long Answer Type Questions)

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

7. a) Why is *Z*-transform technique used in digital control system ? What are its disadvantages ?
   b) What strategy is used for boiler furnace safety in combustion control system ? Explain with detailed logical analysis & diagrams. 5 + 10

8. a) How would you determine the type of process that would require a cascade control & the type that would require feed forward control ? What are the basic differences between them ?

   b) The temperature of a furnace is to be controlled. The rate of flow of fuel to the furnace is the manipulated variable. Pressure of the fuel is the secondary variable. Draw a cascade control scheme for the system. 8 + 7

9. a) What is the *Cv* factor of a control valve ? How is it useful in valve selection and sizing ?

   b) What are the basic differences between a flow control system & a temperature control system ? Why & how are transmission lag cared for, in flow control loops ?

   c) How does viscocity affect the operation of a control valve ? 5 + 7 + 3

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. a) Mention sources of disturbances in process control studies.

    b) Explain the basic process control loop of a process control system with the help of block diagram.

    c) What is offset ? Why does it appear ? How is it eliminated. 4 + 5 + 6