

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  $P.B = 100/K_c$ , 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 ?

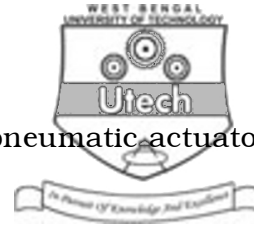


- c) Explain the principle of operation of On-Off controller. Explain the function of differential gap or neutral zone on the performance of On-Off controller.
- d) Discuss analytically the problem for the proportional controller in a first order process.
- e) Explain analytically how the problem can 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,  $C_V = 9.6$

At 40% valve opening,  $C_V = 13.3$

At 80% valve opening,  $C_V = 25.9$

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 :  $3 \times 5$

- a) Solenoid valve
- b) Cascade control
- c) Safety valve
- d) I/P converter
- e) Override control.

=====