



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech-ICE(NEW)/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.*

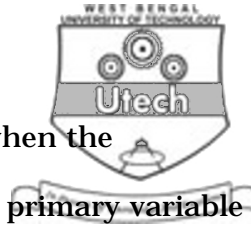
**GROUP – A**

**( Multiple Choice Type Questions )**

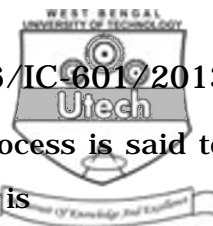
1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

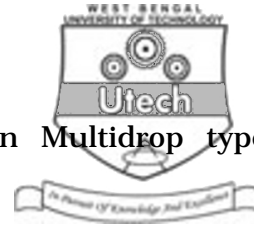
- i) Ratio control system is a special type of
  - a) open loop system
  - b) on-off system
  - c) feed forward system
  - d) feedback system.
- ii) The most commonly used valve for throttling service is
  - a) globe valve
  - b) needle valve
  - c) ball valve
  - d) gate valve.



- iii) The cascade control system is used when the
  - a) secondary variable is faster than primary variable
  - b) primary variable is faster than secondary variable
  - c) gain of primary control is high
  - d) gain of secondary control is low.
- iv) Tuning of controller means
  - a) installation of controller in the loop
  - b) calibration of controller
  - c) adjustment of controller parameters
  - d) adjustment of controlled parameters.
- v) Derivative action reduces
  - a) peak overshoot
  - b) offset
  - c) settling time
  - d) rising time.
- vi) The type of valve used for slurries and high viscous fluid is
  - a) Saunder's valve
  - b) needle valve
  - c) ball valve
  - d) butterfly valve.



- vii) The self regulation of a second order process is said to be optimal when the damping factor ( $\xi$ ) is
- a)  $\xi < 0$
  - b)  $0 \leq \xi < 1$
  - c)  $\xi = 1$
  - d)  $\xi > 1$ .
- viii) Response in feed forward control is ..... than feedback control.
- a) moderate
  - b) slower
  - c) faster
  - d) none of these.
- ix) An example of an Industrial Control System ( ICS ) is
- a) PLC
  - b) DCS
  - c) both PLC & DCS
  - d) none of these.
- x) Which type of network connectivity is generally supported by DCS ?
- a) LAN
  - b) WAN
  - c) MAN
  - d) none of these.



- xi) Which network protocol is used in Multidrop type DCS ?
- a) Token ring protocol
  - b) Token bus or CSMA/CD protocol
  - c) IP control
  - d) TCP protocol.
- xii) 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.  $3 \times 5 = 15$

2. Define 'reset action mode' with a suitable example. What is offset ? 3 + 2
3. What is called 'Neutral Zone' ? How is offset eliminated with the help of integral control mode ? 2 + 3
4. Discuss about the controller setting using Ziegler-Nicholas continuous cycling method and write its limitations.
5. Design an electronic PID controller with the following specifications :  
Proportional Band ( PB ) = 25%  
Derivative Gain (  $K_D$  ) = 20  
Integral Gain (  $K_I$  ) = 2.5.
6. What do you mean by tuning of a controller ? Explain the process reaction curve method for tuning of controller. 2 + 3



**GROUP – C**

**( Long Answer Type Questions )**

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

7. a) What is the difference between the single speed control and multi-speed control ? 4
- b) What is anticipatory control action ? 2
- c) What is the difference between lag time and dead time ? How is offset eliminated with the help of integral control mode ? 4
- d) Draw the block diagram of a typical process control system and describe the function of each block. 5
8. a) i) Define the generation of cavitation of control valve.
- ii) How can cavitation of control valve be eliminated ?  $2 \times 2 \frac{1}{2}$
- b) Define the different steps of selection of control valves. 5
- c) Define the flow coefficient of a control valve. How do  $C_v$  and  $K_v$  differ ?  $3 + 2$



9. a) Define with a suitable example, flow rate through a restriction. 2
- b) Show in a plot about the three parameters of control valves :
- i) Quick opening
  - ii) Linear opening
  - iii) Equal percentage. 5
- c) Define the following terms of control valves : 2 + 2
- i) Rangeability
  - ii) Turn-down.
- d) i) What is valve sizing ?
- ii) Define the pressure profile through a valve. 1 + 3
10. a) What is meant by selective control ? Explain the purpose of cascade control for heat exchanger. 2 + 3
- b) Explain with an example the principle of self-adaptive control. 4
- c) Explain the principle of fuel-air ratio control in combustion control. 6



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

- a) Batch control
- b) Valve positioner
- c) PID control
- d) PLC
- e) DCS
- f) Multivariable control.

=====