



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(ECE-NEW)/SEM-7/EC-704D/2009-10  
2009**

**PROCESS CONTROL ENGINEERING**

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) The recommended sampling time in seconds for  
pressure control loop is

a) 1 - 3

b) 5 - 10

c) 1 - 5

d) 10 - 20.

ii) The antialiasing filter is used in a digital control loop is



- a) discretize the continuous time signal
  - b) reconstruction of the discrete signal
  - c) suppress the unwanted noise
  - d) reduce the quantization effect.
- iii) The actuation device that should be connected to the analog O/P of a PLC is
- a) solenoid
  - b) motor starter
  - c) regulatory control valve with pneumatic actuator
  - d) lamp.
- iv) Normally DCS based control loops controllers are
- a) *P*-type
  - b) *I*-type
  - c) *PID*-type
  - d) none of these.
- v) In fuzzy-logic system, the membership function is part of
- a) rule base
  - b) data base
  - c) fuzzification technique
  - d) none of these.
- vi) Size of PLC depends on



- a) its geometrical size
  - b) its no. of input and output
  - c) area of plants
  - d) all of these.
- vii) A batch process control is
- a) transient under normal conditions
  - b) continuous under normal conditions
  - c) ON-OFF under normal conditions
  - d) none of these.
- viii) Harriott method is a method of
- a) closed loop response method
  - b) open loop method
  - c) open loop response method
  - d) none of these.
- ix) In SMART transmitter input and output signals are respectively
- a) analog and digital
  - b) analog and analog
  - c) digital and digital
  - d) digital and analog.



x) In a PLC, for every I/O channel, there is a corresponding

- a) relay within the PLC
- b) memory location within the PLC
- c) memory location in a RAM outside PLC
- d) none of these.

xi) The voltage for internal operation, a PLC is

- a) 0-5 volt DC
- b) 5-15 volt DC
- c) 5-15 volt DC
- d) 220 volt AC.

xii) An example of an Industrial Control System ( ICS ) is

- a) PLC
- b) DCS
- c) both PLC and DCS
- d) none of these.

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

2. a) What are the different international Field Bus standards for DCS ?
- b) What is meant by data highway ? Why is fibre optic more attractive for data highway design ?  $3 + 2$



3. Explain with an example a total interaction system. Define relative gain matrix. 5
4. What is a heat exchanger ? Explain with a block diagram of heat exchanging process of any plant. 5
5. Draw the basic block diagram of a fuzzy logic based control system. What is membership function ? 3 + 2
6. What is field control element ? Prove that control valve sizing is  $m = C_v \sqrt{\Delta P / G}$

where  $m$  = flow rate

$C_v$  = size coefficient

$G$  = specific gravity of the liquid

$\Delta P$  = pressure differential. 5

### GROUP – C

( Long Answer Type Questions )

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

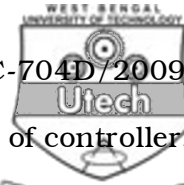
7. a) How a time proportional controller different from on-off controller ? What is integral saturation ?  $2\frac{1}{2} + 2\frac{1}{2}$



- b) Explain a digital control loop with computer as a controller. Draw its block diagram and explain each part briefly. Why is the process part and measurement part different in that same loop ? 10
8. a) What do you mean by 'Pairing controlled and manipulated variables' ? Explain with suitable example. 3
- b) What is relative process gain ? 3
- c) Derive the resultant matrix for considering 'Blending' case, where both flow rate and compositions are to be controlled

where  $X$  and  $Y$  are blended to a specified total flow of composition  $x$ . 9

9. a) What is process reaction curve ? 2



- b) Explain the open loop method for tuning of controller. 4
- c) What is degree of freedom ? Explain with a suitable example. 2 + 2
- d) Derive an expression for the collection efficiency of Howard's particulate collector unit. 5
10. a) What are the advantages of PLC over relay systems ? 2
- b) Draw the block diagram of PLC and explain, briefly the principle of operation. 2 + 3
- c) Explain how PLC can be used for process control application. 4
- d) Convert the following logic diagram to its equivalent PLC ladder diagram. 4



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

- a) Impulse response method for testing
- b) Multi-input multi-output system
- c) DSP processor based control
- d) Model fitting technique
- e) Pulse testing technique.

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