



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS / M.Tech(ME) / SEM-2 / ME-203 / 2013**

**2013**

**INDUSTRIAL AUTOMATION**

*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.*

Question No. 1 is compulsory and answer any *four* from the rest.

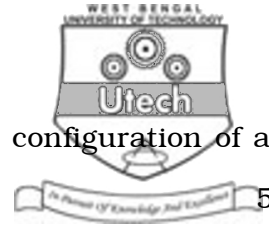
1. a) What do you mean by 'automation' ? 2
- b) Draw the block diagram of a closed loop temperature control system and explain the following terms :
  - (i) Load variable
  - (ii) Manipulated variable
  - (iii) Controlled variable
  - (iv) Final control element. 8
- c) What is the difference between 'Distance Velocity Lag' an 'Transfer Time Lag' ? 4



2. a) Explain two position and multiposition mode of control system. 4
- b) How offset error appears in proportional mode of control system ? Explain how is it eliminated ? 4
- c) Design an electronic proportional-integral controller (analog) with proportional band of 50% and an integral gain of  $0.2\% / (\% \text{ -sec})$ . The 4 to 20 mA input converts to a 0.4 – 2 volt signal and the output is to be 0 – 5 volts. Calculate the values of proportional band and integral action time. 6
3. a) What are the objectives and applications of ratio control in process industries ? 2
- b) Illustrate the different implementation method of ratio control system. 6
- c) Draw the block diagram of Fuel/Air ratio control system in furnace. "Fuel/Air ratio control provides important environmental, economic and safety benefits". Explain. 6
4. a) Discuss the relative advantages and disadvantages of feedback and feed forward control system. 5



- b) "Combined feedback and feed forward control system is more effective for controlling boiler drum level". Explain. 5
- c) Explain override control scheme to protect a boiler system. 4
5. a) Discuss the advantages of cascade control system over conventional control system. 4
- b) Draw the block diagram of cascade control system and derive the overall transfer function. 5
- c) How temperature control in Jacketed CSTR ( Continuous stirred tank reactor ) is achieved in cascade mode ? Explain with diagram. 5
6. a) What do you mean by discrete state process control ? 2
- b) Show the block diagram of PLC and define I/O scan mode and execution mode. 4
- c) Develop the ladder diagram for the following system :
- A motor  $M_1$  is to be turned on by NO START push button.  $M_1$  should remain on for 10 seconds and after 10 seconds another motor  $M_2$  should be turned on. Again after 10 sec.  $M_2$  should be turned off and  $M_1$  should be turned on i.e. in alternative way. The system can be stopped totally by an NC STOP push button. 8



7. a) Explain with neat sketch the general configuration of a Distributed Control System (DCS). 5
- b) Explain the following in connection with DCS :
- (i) Operator's console
  - (ii) Group display
  - (iii) Trend display. 6
- c) What do you mean by "Energy balance control" and 'Material balance control' in distillation column ? 3
8. Write short notes on any *two* of the following : 2 × 7
- a) I/P converter
  - b) Integral wind up
  - c) Direct Digital Control
  - d) Supervisory control.
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