Con. 6171–09.   M.E.(ETRX) Sem II (R)   BB–6170

Process Instrumentation & Controller Design

( 3 Hours )   [ Total Marks : 100

6/1/10

**N.B. :**  (1) Question No.1 is **compulsory**.
   (2) Attempt any **four** questions out of remaining **six** questions.   10:30 to 2:30
   (3) Illustrate your answers with **neat** diagrams wherever **required**.
   (4) Assume **suitable** data if **required** with justification.

1.  Answer the following :–                                                                        **20**
   (a)  Explain various sensors used for measuring pressure.
   (b)  Explain the various factors that govern the choice of control valves.
   (c)  Describe any one process for the measurement of fluid flow.
   (d)  Explain the various intrinsic safety measures that must be undertaken
        in process industry.

2.  (a)  With neat sketches, describe the influent water treatment plant.          **10**
   (b)  What are the advantages of process simulators ?  With the help of a block  **10**
        diagram explain analog or digital process simulator.

3.  (a)  What is a pressure vessel ?  Explain various types of pressure vessels.    **10**
   (b)  Explain the various types of pumps used in process control.  Explain the  **10**
        criteria for their selection for various applications.

4.  (a)  Explain Split-Range Control and Cutback Control.                          **8**
   (b)  What are the advantages of Cascade Control ?  Suggest a procedure for     **8**
        tuning a Cascade control system.
   (c)  Draw a Ladder diagram for the following application :                      **4**
        Assume that the flow into a tank is random and the level in the tank is to
        controlled by opening or closing on outlet solenoid valve (EV-1).  Provide
        the operator with a hand switch to manually turn on the solenoid valve or
        select automatic level control.

5.  (a)  A company needs to purchase a SCADA system that will collect data from  **15**
        its plant analyzers in addition to implementing some required supervisory
        control.  The collected analyzer data will be placed on the facility administrative
        computer.  Design the various stages in this system design and give a description
        of each stage.
   (b)  With the help of a suitable example, explain what you understand by process  **5**
        equation, process characteristics, process lag.

6. (a) Draw the block diagram of an adaptive control system. With an example, **12**
explain how representation of a control system in the form of a mathematical
model is useful in designing an adaptive control system.
(b) Compare and contrast Fuzzy logic control and Classical control systems. **8**

7. (a) Describe the operation of a typical PID controller. How is the tuning of PID **8**
controllers carried out ?
(b) Describe the major operations involved in the manufacturing process of cement **8**
and the purpose of automation in a cement plant.
(c) Explain Ratio Control with the help of an example. **4**

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