

B.E.(EE) Part-IV 8<sup>th</sup> Semester Examination, 2012  
**Process Control Instrumentation (Elective-IV)**  
**(EE-805/2)**

Time : 3 hours

Full Marks : 70

*Use separate answer script for each half.*  
*Answer SIX questions, taking FOUR from first half and TWO from second half.*  
*2 marks are reserved for neatness in each half.*

**Group –A (First Half)**

1. a) Define the following terms :
  - i) Balanced condition
  - ii) Dead time
  - iii) Capacitance and Resistance of a processb) Why should we select the 'differential gap' in two position control?  
c) What is 'OFFSET'? - Explain with diagram.  
d) Draw and explain motion balance type pneumatic PI controller. [ 4+2+2+3]
  
2. a) What is 'wall attachment effect'? Draw and explain one device which uses this principle.  
b) Draw the schematic diagram of a combined system using a level transmitter, a reverse action type relay, a pneumatic PI controller and a sliding stem type valve. Explain the operation step by step.  
c) Name three types of hydraulic relay. [5+4+2]
  
3. a) A proportional controller is used to control the temperature of a furnace at a desired value of 500° C. Range of the instrument is 0-1000° C. Proportional band is 10%. Calculate the minimum and maximum controllable temperature. Comment whether the controller is applicable for the entire range of valve movement or not.  
b) What do you mean by Swelling and Shrinkage effect of Boiler Drum level? For what type of boiler this effect is prominent? What is the corrective mode of control mechanism to be adopted to maintain desired drum level for large size boilers? Explain with proper loop diagram. [5+6]
  
4. a) How can you differentiate the 'distributed control system' (DCS) from a centralized control system. Explain constructional features of a DCS and their basic functions.  
b) What is the effect of 25% to 75% P.B. value on valve opening.  
c) Name two Sliding-Stem control valves and two Rotating-Shaft control valve. [5+2+4]
  
5. a) What is the basic difference of rate-type and reset-type of control action? Which one amongst them is capable of minimizing offset?

*(Turn over)*

- b) What is the basic function of an actuator? Draw and explain the operation of an actuator connected with a rotating shaft type control valve?
- c) In your laboratory what type of closed loop process have you used? Which type of sensor, controller, final control element, actuator are used in the entire control scheme. [4+2+5]
- 6 Write short notes on :
- a) Hydrastep system;
- b) Flapper Nozzle system;
- c) Direct action type relay. [4+4+3]

**Group -B (Second Half)**

7. a) What is a PLC? How does a PLC sense a very short input pulse? Discuss in terms of the response time diagram of a PLC
- b) Give the specifications of a triac output of a PLC and draw the triac output circuit.
- c) A motor M2 is to be automatically started 10 minutes after motor M1 is started by a START-button and both the motors are to be stopped simultaneously by a single STOP-button. Draw the ladder diagram for the process and implement the same by suitable interface connections with the PLC. [4+3+4]
8. a) What is the basic principle of flow measurement? Name some industrial flow sensors.
- b) Discuss with neat diagram the operating principle of a transit-time ultrasonic flow sensor. Why various sensor arrangements like Z-, V-, W- configurations are used?
- c) How Laser Doppler sensors can measure blood perfusion in the tissue? [3+5+3]
9. a) Discuss the working principle of piezoelectric transducers. Define the  $d$ -,  $g$ - and  $h$ - coefficients.
- b) Name some natural and synthetic piezoelectric materials showing their applications.
- c) Discuss the operating principle of a piezoelectric accelerometer. [5+3+3]
- 10 Write short notes on *any two*: [5½ x 2 = 11]
- a) pH measurement by membrane sensor (single probe);
- b) Input specifications of PLC for both dc and powered ac;
- c) Ultrasonic Doppler Flowmeter;
- d) Traffic light control by PLC.