

B.E. (EE) Part-IV 8th Semester Examination, 2007

Process Control Instrumentation

(Elective-II) (EE-803/2)

Time : 3 hours

Full Marks : 100

Use separate answerscript for each half.

Answer SIX questions, taking THREE from each half.

Two marks are reserved for neatness in each half.

FIRST HALF

1. a) What is Hydrastep System? Draw and explain basic building blocks of a Hydrastep System.
b) Name the variables to be measured for turbine pedestal vibration control. Explain the principle of active sensor useful for turbine pedestal vibration velocity measurement. [16]
2. a) Design a motion balance type pneumatic PI controller. How K_c and T_i can be varied in the above type controller.
b) Explain why signal in the range of 3 - 15psi is taken in any pneumatic system.
c) Explain the operation of a reverse action type relay. [8+4+4]
3. a) What is 'swelling' and 'shrinkage' Phenomena. What is the reason behind it?
b) What is the difference between 3-term and 3-element controller? What are the elements to be taken in case of 3 element controller. Why this control is more efficient compared to 1E or 2E control.
c) What is the difference between 50% and 100% P.B. How it affects the valve movement? [6+6+4]
4. a) Draw and explain the use of Jet-pipe in relation with hydraulic controller.
b) How OFFSET can be eliminated in P+I control action? (Explain graphically).
c) What is Co-anda Effect? Describe the operation of a proportional controller. [4+4+8]
5. a) A proportional controller is used to control the level of a drum at a desired value of 500m. Range of instrument is 0–2000m. Proportional band is 10%. Controller has an O/P range of 0.2 to 1 kg/cm². If the output is 0.6 kg/cm², the level is at desired value, find the level corresponding to 0.2 kg/cm² and 0.52 kg/cm².
b) How a distributed control system (DCS) can be differentiated from a centralised control system? Draw the layered structure of a distributed control system and explain it. [8+8]

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6. a) Explain the operation of NOTC and NOTO timing relays.
b) What are 'limit switches'?
c) A 110 V dc shunt generator is to be started with a nominal load current of 1 A. Three load resistances, 110 ohms each, are to be added in parallel after every 5 seconds such that the final armature current becomes 4 A. Draw the control circuit diagram using ladder logic to implement the above. Translate the same to a ladder logic program for any known PLC that you have used. Also give the power circuit diagram.
d) What is 'Instruction List' method of programming a PLC? Explain with a small example. [3+2+8+3]
7. a) Describe with neat sketches, the construction and working of a rotameter. State one important advantage and one important disadvantage of the Rotameter.
b) A miniature pitot tube is used to measure the velocity of blood flow and the differential pressure gauge records a pressure of 1 mm. of mercury. If the density of blood is 1020 kg / m^3 , calculate blood velocity.
c) What is Reynold's number? What factors does it depend on?
d) Briefly state the principle of operation of a flowmeter used in case of electrically conducting fluids. [7+4+3+2]
8. a) What is the difference between 'piezoelectric sensing' and 'piezoresistive sensing'? Explain with an example of each.
b) What is the basic principle of operation of a semiconductor temperature sensor? Differentiate between 'voltage output' and 'current output' types.
c) What is a 'Humistor'? How is it used to measure relative humidity of air?
d) What is a 'smart' sensor? Explain with the example of an IC-based smart sensor. [5+4+3+4]
9. a) How is telemetry different from remote sensing?
b) In digital telemetry, what is Pulse Code Modulation (PCM)? What are its advantages?
c) What are the contents of the Accumulator and major flags after the following 8051 program segment is executed:

```
mov R0, #60
mov R1, #30
mov R2, #45
mov A, R1
add A, R2
subb A, R0
xrl A, #20
```


d) How is the baud rate for serial transmission determined in 8051? What are the two SFRs related to serial transmission. Write a small assembly language program to show how a byte can be serially transmitted in 8051. [2+4+3+7]

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10. Write short notes on any *four* of the following:

[4×4]

- a) Orifice plates
- b) p-H meters
- c) Piezoelectric accelerometer
- d) Watch dog timer in PLC
- e) FM / FM telemetry
- f) Automation hierarchy of computer-aided process control plants
- g) Memory map of 8051

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