

COMPREHENSIVE EXAMINATION (Closed Book)

Course No : INSTR UC312
Course Title : Industrial Instrumentation & Control
Date : 02.06.11
Time : 3 Hours Max.Marks : 80 (40 %)

NOTE: 1. ANSWER ALL THE QUESTIONS IN SEQUENTIAL ORDER.

2. ALL THE SYMBOLS AND WORDS CARRY THEIR USUAL MEANINGS, UNLESS OTHERWISE STATED.

PART A

[10*3=30M]

- I. a. The pressure in a tank varies from 20 psi to 100 psi. The pressure in the tank is desired to be kept at 50psi. What is the full scale error when pressure inside the tank is 30psi?
- b. Mention the tuning parameters for PID controller according to Ziegler-Nichols method.
- c. Draw the responses for step input to P, I, D, PI, PD and PID controllers.
- d. Draw the inherent valve characteristics of control valve.
- e. Define Rangeability.
- f. What are the salient features of cascade control system?
- g. What are the difference between supervisory computer control and direct digital control?
- h. Write short notes on lined butterfly valve.
- i. What are the advantages & disadvantages of feed forward configuration?
- j. Explain about self tuning regulator.

PART B

2. Draw the RLD and LLD for the reciprocating action shown below in Figure1.

The motor is stopped when the limit switch 2LS escapes to open the table. When the start button is pressed the table starts moving forward to the right. When it moves away from 2LS the contact immediately closes. The motor reverses its direction and the table opens 1LS and moves in the reverse direction towards left until 2LS is opened again causing the forward direction. This cycle of reciprocating motion continues until 2LS opens after the stop push button is pressed and no motion should occur until the start push button is pressed again. All LS are NC. [10 M]

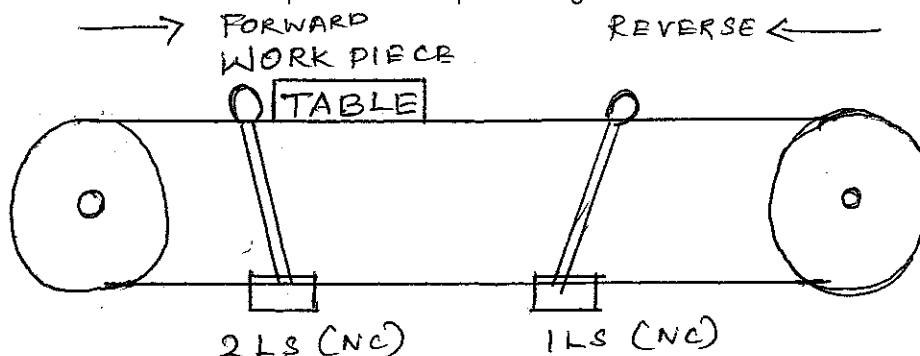


FIG (1). RECIPROCATING MOTION

3. a. An integral controller is used for level control with a set point of 12m within a range of 10 to 15m. The controller output is 22% at set point. The constant K_i is 0.15% per second per percent error. If the level jumps to 13.5m, calculate the controller output after 2 seconds. **[5 M]**

b.. A PI controller is used to control the pressure in a tank which varies from 40psi to 140psi. Desired pressure is 90 psi. Controller output is to change by 100% upon 40 psi pressure deviation. Reset rate is 1/5 repeats per minute and controller output at zero error is 50%. Calculate the controller output at the end of 2 minutes, when pressure in the tank becomes 80psi. **[5 M]**

4. Using Hebb rule, train the AND Gate to the neural network. Try the maximum possible ways and indicate your comments. The order of the training is **[10 M]**

X_1	X_2
1	1
1	0
0	1
0	0

5. Draw a hierarchical DCS structure and explain function of each level. What are the distinguishing features of DCS? **[10 M]**

6. a. Classical set theory classifies the ambient temperature as only hot or cold (i.e either 1 or 0)

$$\mu_{\text{HOT}}(x) = \begin{cases} 1 & \text{if } (x \geq 50^\circ\text{F}) \text{ classifies as hot} \\ 0 & \text{if } (x < 50^\circ\text{F}) \text{ classifies as cold} \end{cases}$$

Fuzzy logic defines "hotness" of ambient temperature with a membership function as given by:

$$\mu_{\text{HOT}}(x) = \begin{cases} 0 & \text{if } (x \leq 20^\circ\text{F}) \\ \frac{x - 20}{80} & \text{if } (20^\circ\text{F} \leq x \leq 100^\circ\text{F}) \\ 1 & \text{if } (x \geq 100^\circ\text{F}) \end{cases}$$

Show the above membership function in a table. Also, draw membership function for "hotness" as well as "coldness". Tabulate the degree of hotness and coldness for 20 to 100° F at intervals of 10° F.

[5 M]

b. Consider the fuzzy sets S and T. Find, $\mu(S \cup T)$, $\mu(S \cap T)$, $\mu(S \cup S^1)$ and $\mu(S \cap S^1)$

$$S = \{0.75, 0.3\} = A/0.75 + B/0.3$$

$$T = \{0.4, 0.6\} = A/0.4 + B/0.6$$

[5 M]

ALL THE BEST

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
TEST II (Open Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 17.04.2011 Time: 50 Minutes M.M = 20(20%)

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- NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.
3. Text book & hand written class notes are allowed.

1. Using Multiplication Instruction, draw the RLD for an oven temperature control Program. In this, PLC calculates the upper and lower dead band or on/off limits about the set point. The set point temperature is adjustable by means of thumbwheel switches and an analog thermocouple interface module is used to monitor the current temperature of the oven. In this example the set point is 400°F. Therefore the electric heater will be turned on when the temperature of the oven drops of less than 396°F and stay on until the temperature rises above 404°F. [5M]

2. Using Hebb rule, train the EX OR gate to the neural network. Try the maximum possible ways, indicate your comments and find the sloution. The order for the training is,

X1	X2
1	1
0	1
1	0
0	0

[7M]

3. Find the Truth ness of each proportion given.

The Ranges are,

Age 15 to 45 Years

Weight 30 to 50 Kg

Height 4 to 6 Feet

The crisp data's are Age = 30 Years, Height =5 feet, Weight =35 Kg

1. You are young or Normal and tall is true.

2. You are tall and average or old is very true

[4M]

4. Mention any four important differences between the FFC and FBC.

[4M]

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
TEST I (Closed Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 27.02.2011 Time: 50 Minutes M.M = 25 (25%)

NOTE: 1 All the symbols and words carry their usual meanings, unless otherwise stated.

2. Answer all the questions.

3. No of pages : 2

1. Explain the Architecture of PLC with neat diagram. [6M]

2. a. Draw the RLD for the following motor control specifications.

i. A motor must be started and stopped from any one of the three start and stop push button stations.

ii. Each start and stop stations contains one NO (normally open) start button & one NC(normally closed) stop button.

[3M]

b. Draw the RLD to turn the lights L1 and L2 on and off using latch instructions. You are provided with two pushbuttons to on and off the lights. [3M]

3. a. An integral controller is used for speed control with a set point of 9 rpm with in a range of 5 to 20 rpm. The controller output is 28% initially. The constant $K_I = -0.22\%$ controller output per second per percentage error. If the speed jumps to 15rpm, calculate the rate of controller output change & controller output after 2 sec's for a constant e_p . [3M]

b. When pen point and set point are suddenly deviated by 0.5cm at $t=0$ onwards, the response of PI controller is given below. Find K_p & T_r . (Assume $Z_0 = 12\text{ma}$)

<u>Time</u>	<u>Z</u>
Less than 0	12 ma
0	14 ma
2 min	15 ma
7min	17.5ma

[4M]

PTO

4. A transient disturbances test is run on a process loop. The results of 9% controlling variable change gives a process reaction graph as shown in Fig 1. Find the settings for three mode actions. How much is the proportional band? [6 M]

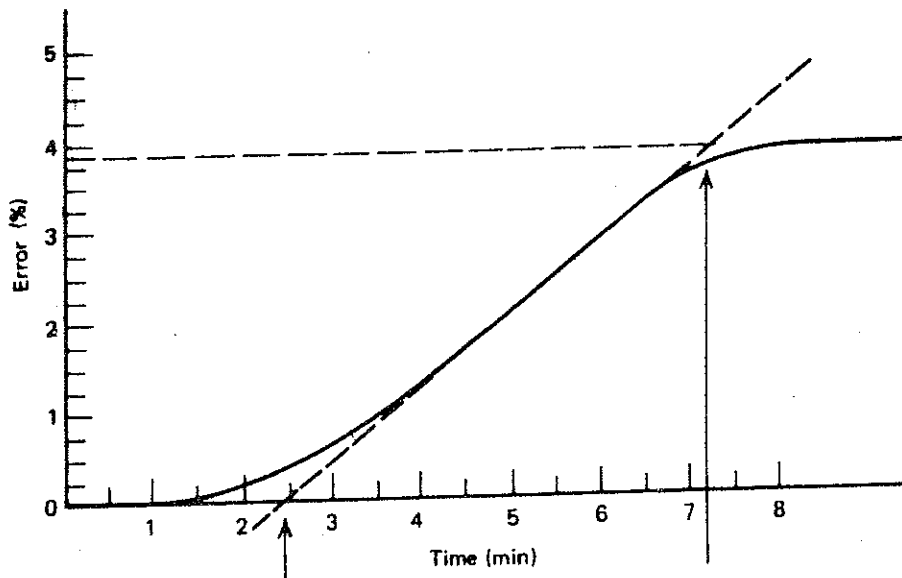


Fig 1. PROCESS REACTION GRAPH

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BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
QUIZ II / (Closed Book)
BE (Hons) III year EIE

Course No : INSTR C312

Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL

Date : 04.05.2011

Time: 20 Minutes

M.M = 14 (7%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.

2. Answer all the questions.

[14*1=14M]

- 1..... valve is used for flow of corrosive fluids in the process.
2. Which ball valve will give high performance in controlling the process?
3. According to working principle how do you classify the control valve?
4. What is the basic activation function used in neural networks?
5. What are the types of architectures in neural network?
6. What is knowledge base in fuzzy logic?
7. Give any application for unsupervised learning method.
8. What are the composition operations in Fuzzy logic?

9. Which valve has got the elastomer?

10. What is the type of the valve or port which will give the quick opening characteristics?

11. How Louvers valve is different form butterfly valve?

12. Equal percentage valve otherwise called as.....

13. What is the difference between single seated and double seated valve in construction?

14. Optimal control can be obtained by valve.

ALL THE BEST

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ID No:

BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2010-2011
QUIZ I / (Closed Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 23.03.2011 C PUm Time: 20 Minutes M.M = 16 (8%)

NOTE: 1. All the symbols and words carry their usual meanings, unless otherwise stated.
2. Answer all the questions.

1. Define PLC. [2M]

2. Mention few disadvantages of Relay sequencer. [2M]

3. A mixer motor is used to stir the liquid in the tank automatically when the input pressure reaches the preset value. In addition, the direct manual operation of the motor is also provided to stir the liquid. Draw the RLD. [2M]

4. Draw PLC ladder diagram to realize two inputs EX-OR Gate. [2M]

5. Develop a ladder that will allow three switches in a room to control a single light source. Switching on any one of the three switches turns the light on; but all the three switches have to be off for the light to go off. [2M]

(Refer Figure (1) for Q.No 6 to 9.)

6. For Figure (1), when the timer will start timing? [1M]

7. For Figure (1), when the timer will reset? [1M]

8. For Figure (1), when the output will be energized? [1M]

9. For Figure (1), the time delay of the timer is [1M]

10. What is the difference between on delay and off delay timer? [1M]

11. What is scan time?[1M]

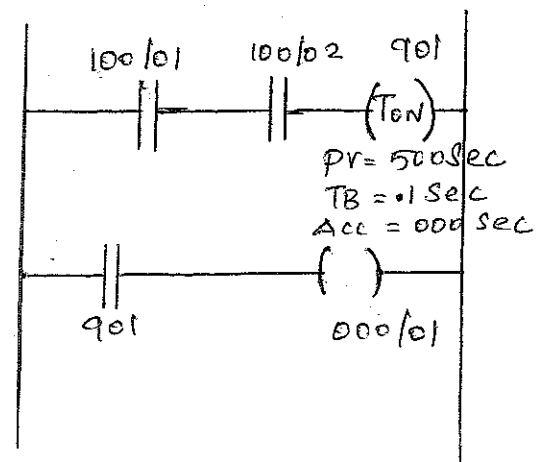


FIGURE (1)