BITS, PILANI – DUBAI
Dubai International Academic City, Dubai, UAE
Year III – Semester II 2009 – 2010

COMPREHENSIVE EXAMINATION (Closed Book)

Course No	: INSTR C312		
Course Title	: Industrial Instrumentation & Control		
Date	: 26.05.10		
Time	: 3 Hours	Max.Marks	: 40 (40 %)

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

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

(8 x 5 = 40)

1. Design a RLD for the following requirements.

The application requires an alarm to sound when a supply system leaks 5 lb or more of raw material in to the vessel after a preset weight of 500 lb has been reached. When the start push button is pressed the filling solenoid and filling indicating light are turned on and raw material is allowed to flow in to the vessel. When the weight reached 500 lb the filling solenoid is deenergized and the flow is cutoff. At the same time, the filling pilot light is turned off and fill pilot light indicator is turned on. If the filling solenoid leaks 5 lb or more of raw material in to the vessel, the alarm will energize and stay energize until the over flow level is reduced below 5 lb over flow limit. (Make use of Subtraction instruction). [5 M]

2. a. Mention the parameter settings of P, PI, PID controllers using Ultimate cycle method.
b. An electronic PI controller is subjected to the error 3, PB = 80%. & Reset time is 2 min .Find the output when the controller output saturates. [3+2 M]

3. a. Define control valve. What are the basic elements of the control valve?
b. Briefly explain the classifications of the control valve. [2+3 M]

4. a. What is meant by adaptive control and under what situations it has to be selected?
b. Explain about the artificial neuron structure.
[3+2 M]

5. 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, [5 M]

X1	X2
1	1
1	0
0	1
0	0

6. Find Maximum - Minimum composition, Maximum - Product Composition & Relational joint for A & B. [5 M]

$$A = \begin{bmatrix} 0.7 & 0.5 & 0.0 \\ 1.0 & 0.0 & 0.0 \\ 0.0 & 1.0 & 0.0 \\ 0.0 & 1.0 & 0.9 \end{bmatrix} \qquad B = \begin{bmatrix} 0.6 & 0.8 \\ 0.0 & 1.0 \\ 0.0 & 0.9 \end{bmatrix}$$

7. a. What is meant by cascade control system?

b. Under what situation we have to select the cascade control system?

c. 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 15 rpm, calculate the rate of controller output change & the controller output after 2 sec's for a constant e_p. [1+1+3 M]

8. Explain the architecture of the Distributed Control System with neat diagram and mention its important features. [5 M]

ALL THE BEST

BITS, PILANI .DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2009-2010
TEST II (Open Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 09.05.10 **Time: 50 Minutes** **M.M = 20 (20%)**

Note: Handwritten class notes and text book are allowed.

1. The hot material demand changes from a flow of 1.3 to 1.8m/min. If the controller output is normally 50% with a constant of Kp =12% per percentage for the set temperatures, then calculate the new controller output and offset error. Assume a temperature/ flow scale factor of 0.028% controller output. [5M]

2. a. Draw the response for P, I, D, PI, PD and PID controllers for step input.
   b. What is meant by saturation problem in cascade control? [3+2M]

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 [5 M]

4. Find maximum-minimum, maximum- product and relational joint of A & B

$$A = \begin{bmatrix} 1.0 & 0.0 & 0.7 \\ 0.3 & 0.2 & 0.0 \\ 0.0 & 0.5 & 1.0 \end{bmatrix} \qquad B = \begin{bmatrix} 0.6 & 0.6 & 0.0 \\ 0.0 & 0.6 & 0.1 \\ 0.0 & 0.1 & 0.0 \end{bmatrix}$$

[5 M]

BITS, PILANI .DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2009-2010
Test - 1 **QUIZ I (Closed Book)**
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 28.03.2010 **Time: 50 Minutes** **M.M = 25 (25%)**

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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. [5 M]

2. Draw the RLD diagram for the following application.

Three motors have to be started with the following sequences.

a. Start the motor one immediately once the start push button is pressed.

b. Start the motor two and stop the motor one after 15 sec the motor one is started.

c. Start the motor three and stop the motor two after 15sec the motor two is started.

d. Stop push button is provided to stop all the motors at any time

Make use of single timer for programming the PLC. [5 M]

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

X1	**X2**
1	1
1	0
0	1
0	0

[7.5M]

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

X1	**X2**
1	1
0	1
1	0
0	0

[7.5M]

ALL THE BEST

Name : ID No:

BITS, PILANI .DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2009-2010
QUIZ II (Closed Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 12.04.2010 Time: 20 Minutes M.M = 14*1= 14 (7%)

Note: Each question carries 1mark. All the symbols and words carry their usual meanings, unless otherwise stated.

1. Define differential gap.

2. Proportional controller as a single mode, how will you eliminate the offset?

3. Derivative controller as a single mode is not recommended for any process. Why?

4. What is the disadvantage of PID controller?

5. How will you calculate the Log ratio in process reaction curve method?

6. How will you calculate the controllability ratio in Cohen coon method?

7. What is the Laplace transform of PID controller?

8. What is the status of settling time in preact control .Justify your answer.

9. Which controller is used for Temperature control process?

10. In a open loop transient response method, T_I = ... for the PI mode.

11. In ultimate cycling method, for Quarter Amplitude criterion the T_I is calculated as .....for PID mode.

12. ISE stands for ..... & when it is used?

13. How will you calculate the critical time and critical gain in frequency response method for tuning a controller?

14. ITAE stands for ..... & when it is used?

Name : **ID No:**

BITS, PILANI .DUBAI
Dubai International Academic City, Dubai, UAE
Semester II 2009-2010
QUIZ I (Closed Book)
BE (Hons) III year EIE

Course No : INSTR C312
Course Title : INDUSTRIAL INSTRUMENTATION & CONTROL
Date : 22.02.2010 **Time: 20 Minutes** **M.M = 10*2= 20 (8%)**

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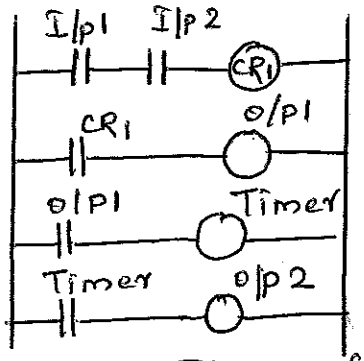
1. Decide whether each of these statements is True (T) or False(F).
For the ladder diagram shown in Figure (1), When there is just an input to In 1:



FIGURE(1)

(i) The timer starts.
(ii) There is an output from output 2.

a. (i) T (ii) T
b. (i) T (ii) F
c. (i) F (ii) T
d. (i) F (ii) F

2. Decide whether each of these statements is True (T) or False(F).
For the ladder diagram shown in Figure (1) ,When there is just an input to In 1and input to In2 then there is an output from out 2 which:

(i) Starts Immediately.
(ii) Ceases after the timer preset time.

a. (i) T (ii) T
b. (i) T (ii) F
c. (i) F (ii) T
d. (i) F (ii) F

3. Decide whether each of these statements is True (T) or False(F).
For the ladder diagram shown in Figure (2) , when the counter is set to 5, there is an output from out 1 every time:

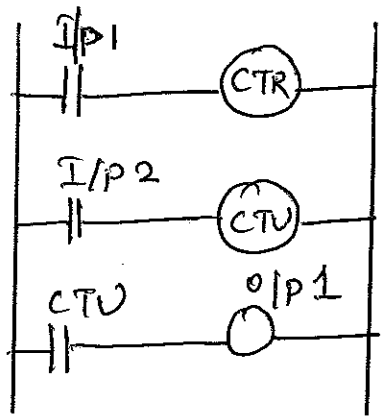


FIGURE (2)

(i) In 1 has closed 5 times.
(ii) In 2 has closed 5 times.

a. (i) T (ii) T
b. (i) T (ii) F
c. (i) F (ii) T
d. (i) F (ii) F

4. Decide whether each of these statements is True (T) or False(F).
   For the ladder diagram shown in Figure (2) ,
   (i) The first rung gives the condition required to reset the counter.
   (ii) The second rung gives the condition required to generate pulses to be counted.

   a. (i) T (ii) T
   b. (i) T (ii) F
   c. (i) F (ii) T
   d. (i) F (ii) F

5. Decide whether each of these statements is True (T) or False(F).
   For the ladder diagram shown in Figure (2), when there is an input to In 1;
   (i) The counter contacts in the third rung closes.
   (ii) The counter is ready to start counting the pulses from In 2

   a. (i) T (ii) T
   b. (i) T (ii) F
   c. (i) F (ii) T
   d. (i) F (ii) F

6. Draw the RLD to implement NOT operation.

7. Draw the RLD to sound the horn with the help of LS1 and LS2 or LS3 and LS4.

8. Draw the RLD to turn on the red light using Examine off Instructions.

9. Draw the RLD to turn the lights L1 and L2 on and off using Latch instructions. You are provided with two pushbuttons for on and off conditions for the lights.

10. Define programmable logic controller.