Industrial Process Control and Instrumentation

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Classroom: Tech 210 - 12

Course Description: -

Technological advancements in process monitoring, control and industrial automation over the past decades have contributed greatly to improve the productivity of virtually all manufacturing industries throughout the world. This course introduces the basic concepts of process control loops and modeling of industrial instrumentation and automation. The first part covers the analysis of different components (sensors and actuators) of control loops and controlling of this process by using PID controller. Also in first part student will work on the modeling and control of conveyor station using the FESTO machine.

The second part of the course covers the Programmable logic controller (PLC), we briefly introduced software and hardware of Mitsubishi and Allen Bradley PLC's. Especially we pay attention on ladder logic programming for different processes and applications. Lab work will be aimed for making different logics in RS500, RS5000 and GX-Developer (Melsec) languages for different ladder logic.

Course Objective: -

Upon successful completion of this course, the student should be able to:

- Define primary measurement and signal transmission principles and equipment and open loop and closed loop (feedback) systems.
- Define the use of automatic controllers in automated control systems and describe the use of final control elements in automated control systems.
- Explain measurement, signal transmission, controller, and control element applications for common process variables in the paper industry.
- Practical perspectives on pneumatics, electronic instruments, and digital logic devices such as PLC’s, different types of sensors.
- Provide students with state-of-the art coverage of the full spectrum of industrial maintenance and control, from servomechanisms to instrumentation.
- To learn about components, circuits, instruments, control techniques, calibration, tuning and programming associated with industrial automated systems.

Course Outcomes: -

Students are able to understand principles involved in the measurement and control of industrial processes; become familiar with International Society of Automation (ISA) standards, instruments and devices available for designing process control systems; understand and prepare technical design documentation; and gain understanding of programmable logic controllers (PLCs) and ladder programming, and implementation of control theory in industrial systems.
**Course Topic:**

Lesson 1 – Introduction
- Introduction to Course
- Industrial processes and automation
- Automation Components and benefits of automation
- PI Diagrams and Symbols
- Control System and its types

Lesson 2 – Sensors and Actuators
- What is Sensor?
- Classification of Sensors
- Working principles and application of sensors
- What is actuator?
- Classification of Actuators
- Working principle and application of actuators
- Modeling and Control of Conveyor Station

Lesson 3 – Level and Flow Control Loop
- Introduction to Control System
- Level Control Loop
- Analysis of level sensor used in FESTO Machine
- Flow Control Loop
- Analysis of flow sensor used in FESTO Machine

Lesson 4 – Pressure and Temperature Control Loop
- Pressure Control Loop
- Analysis of pressure sensors used in FESTO Machine
- Temperature Control Loop
- Analysis of Temperature sensors used in FESTO Machine

Lesson 5 – Commissioning of Control loops using PID Controller
- What is PID?
- Commissioning of Level, Flow, Pressure and Temperature Control loop
- Mixing Station

Lesson 6 – Programmable Logic Controller
- Introduction to PLC
- Architecture of PLC
- How PLC works?
- What are the Programming languages
- Understanding the logic diagram

Lesson 7 – Programming Software FOR MITSUBISHI & ALLEN BRADELY PLC
- How to establish a communication between PC & PLC
- Introduction to GX developer software for MITSUBISHI PLC
- Introduction to Rockwell Software (RSLogix 500)
- Basic programming instruction

Lesson 8 – Programming Instruction
- Instruction and Binary interpretation
- Bit Instruction
- Timers and Counters
- Comparison Instruction
- Class Exercise
Lesson 9 – Programming Instruction
- Math Instruction
- Move Instruction
- Class Exercise

Assignments: -

In this course, students have to work on Conveyor Station, FESTO Machine and PLC. To the completion of this course, each student has to submit the following assignments.

Assignment 1 – Conveyor Station
Assignment 2 – Analysis of Level and Flow Sensors
Assignment 3 – Analysis of Pressure and Temperature Sensors
Assignment 4 – Commissioning of Level, Flow, Pressure and Temperature Control loop using PID Controller
Assignment 5 – PLC Program
Assignment 6 – PLC Program
Assignment 7 – PLC Program
Assignment 8 – PLC Program

Grading: -

Midterm: 25%
Final: 45%
Assignment: 15%
Attendance: 15%

Textbook: -

Refer to the Blackboard. All manuals and reports are uploaded on Blackboard.

Cheating and Plagiarism: -

It is student’s responsibility to familiarize himself or herself with and adhere to the standards set forth in the policies on cheating and plagiarism as defined in chapter 2 and 5 of the key UB http://www.bridgeport.edu/pages/2623.asp or the appropriate graduate program handbook.