WWTR 123 Course Outline as of Summer 2022

CATALOG INFORMATION

Dept and Nbr: WWTR 123 Title: INSTRUMENTATION & CNTRLS
Full Title: Instrumentation and Controls
Last Reviewed: 2/13/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.67	17.5	Lecture Scheduled	46.73
Minimum	3.00	Lab Scheduled	1.00	4	Lab Scheduled	17.50
		Contact DHR	0		Contact DHR	0
		Contact Total	3.67		Contact Total	64.23
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 93.45 Total Student Learning Hours: 157.68

Title 5 Category:	AA Degree Applicable
Grading:	Grade or P/NP
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	ENVT 123

Catalog Description:
Applications and uses of water, wastewater, and industrial control systems including switches, relays, alarms, motors, transformers, test equipment, control systems, telemetering, and System Control and Data Acquisition (SCADA).

Prerequisites/Corequisites:

Recommended Preparation:
Course Completion or Concurrent Enrollment in WTR 101

Limits on Enrollment:

Schedule of Classes Information:
Description: Applications and uses of water, wastewater, and industrial control systems including switches, relays, alarms, motors, transformers, test equipment, control systems, telemetering, and System Control and Data Acquisition (SCADA). (Grade or P/NP)
Prerequisites/Corequisites:
Recommended: Course Completion or Concurrent Enrollment in WTR 101
Limits on Enrollment:

Transfer Credit:
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Effective:	Inactive:
UC Transfer:	Effective:	Inactive:

CID:

Certificate/Major Applicable:
Both Certificate and Major Applicable

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Utilize instrumentation and controls found in water and wastewater plants and other industrial systems.
2. Identify, describe and work with instrumentation and control loops.

Objectives:
In order to achieve these learning outcomes, during the course the students will:
1. Interpret symbols used in control and instrumentation circuits.
2. Identify various types of motor control devices.
3. Identify the main parts and functions of a SCADA (Supervisory Control and Data Acquisition) system.
4. Apply the principles of electronic circuit theory.
5. Identify sensors, signal and control loop logic.
6. Describe areas of interaction between automated systems and motor controls.
7. Describe and give examples how automation is beneficial to the water or wastewater utility.

Topics and Scope:

I. Introduction to Instrumentation and Controls
   A. Terminology
   B. Sensors
   C. Transmission
   D. Readouts
   E. Elements of control
   F. Benefits to wastewater utilities
   G. Energy optimization for control systems
II. Introduction to Basics of Electricity
   A. Use of Ohm’s law
   B. Types of power: Direct Current (DC), single phase, and three phase

III. Use of Schematic Drawings in Motor Control Circuits
   A. Standard drawing symbols
   B. Ladder logic drawings
IV. Types of Control Systems and their Components
   A. Basic components
   B. Wetwell levels
   C. Flow controls
   D. Chemical dosing systems
   E. Programmable Logic Controllers (PLCs)
V. Types of Meters used in Testing Electric Equipment
   A. Multimeter
   B. Volt/amp meter
VI. Introduction to Instrumentation and Telemetry
   A. Types of telemetering and equipment used
   B. Use of phone lines
   C. Use of radio
VII. Treatment Plant Equipment
   A. Turbidity meter
   B. pH analyzer
   C. Flow meters/switches for status and alarms
   D. Level meters
   E. Pressure sensing equipment
   F. Motor protection
   G. Chlorine equipment
   H. Pumps
   I. Motors
   J. Valves
   K. Actuators
   L. Motor control centers
VIII. Supervisory Control and Data Aquisition Systems (SCADA)
   A. Main parts of a SCADA system
   B. Main functions of a SCADA system
IX. Example Laboratory Exercises
   A. Ohm’s law and power (Topic II)
   B. Reading schematic diagrams (Topic III)
   C. Control systems and their components (Topic IV)
   D. Using meters to test equipment (Topic V)
   E. Using telemetry computer interfaces (Topic VI)
   F. PLCs (Topic IV)
   G. Pump and flow meter controls (Topic VII)
   H. Treatment plant equipment (Topic VII)
   I. Field trip to water or wastewater treatment plant (Topic VII)
   J. SCADA (Topic VIII)

Assignment:

Lecture Related Assignments:
1. Reading assignments (approximately 20 pages per week)
2. Weekly problem solving homework assignments (12-15)
3. Quizzes (0-10) and/or midterms (0-2)
4. Final exam

Lab Related Assignments:
1. Laboratory activities and reports (8-12)
2. Field trip reports (0-2)

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Field trip reports	Writing 0 - 10%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework assignments, laboratory reports	Problem solving 50 - 70%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Quizzes, midterms, final	Exams 30 - 50%

Other: Includes any assessment tools that do not logically fit into the above categories.

Attendance and participation	Other Category 0 - 10%

Representative Textbooks and Materials:
AWWA Instrumentation and Control. 3rd ed. AWWA. 2001 (classic)
Instructor prepared materials