WWTR 123 Course Outline as of Fall 2012

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	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	5	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

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:

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:
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

Outcomes and Objectives:
Upon completion of the course, students will be able to:
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 (System 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. Different types of power used; single phase, three phase and DC

III. Use of Schematic Drawings in Motor Control Circuits
 A. Standard drawing symbols
 B. Ladder logic drawings
 C. Control circuit logic

IV. Types of Control Systems and their Components: Part 1
A. Basic components
B. Motor Control Circuits

V. Types of Meters used in testing electric equipment
A. Multimeter
B. Volt/amp meter
C. Megohmmeter
D. Phase and motor rotation test set
E. Testing and record keeping

VI. Introduction to Instrumentation and Telemetry
A. Types of telemetering and equipment used
B. Use of phone lines
C. Use of radio

VII. Instrumentation and Control
A. Programmable Logic Controllers (PLC)
B. Control loops- proportional, integral and derivative (PI&D)
C. Remote Telemetry Units (RTU)

VIII. Water and Wastewater Controls, Meters, Pumps and Valves
A. Flow meters
B. Automatic valves for pump and flow control

IX. 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 used in water and wastewater systems

X. Distribution and SCADA Systems
A. Main parts of SCADA system
B. Main functions of SCADA system

XI. Laboratory Exercises
1. Ohm's Law and Power (Topic II)
2. Reading Schematic Diagrams (Topic III)
3. Control Systems and their Components: Part 1 (Topic IV)
4. Control Systems and their Components: Part 2 (Topic IV)
5. Control Systems and their Components: Part 3 (Topic IV)
6. Using Meters to Test Equipment ((Topic V)
7. Testing Schedules/Record Keeping (Topic V)
8. Field trip or equipment demonstration (Topic VI)
9. Use of Computer Interface with Telemetry Systems (Topic VI)
10. PLC: Part 1 (Topic VII)
11. PLC: Part 2 (Topic VII)
12. Pump and Flow Meter Controls (Topic VIII)

13. Treatment Plant Equipment (Topic IX)
14. Field trip to water or wastewater treatment plant (Topic IX)
15. SCADA: Part 1 (Topic X)
16. SCADA: Part 2 (Topic X)

Assignment:

1. Reading assignments averaging 20 pages per week.
2. Weekly problem solving homework assignments related to instrumentation and control systems.
3. Quizzes (10-15)
4. Final exam (objective questions)
5. Possible related field trip and report (5-10 pages)
6. Laboratory activities, demonstrations and reports

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 report	Writing 0 - 10%

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

Homework problems, Laboratory activities, 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.

Weekly quizzes; final exam	Exams 30 - 50%

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

Field trip	Other Category 0 - 10%

Representative Textbooks and Materials:
1. AWWA Instrumentation and Control, edited by AWWA, 2001, 3rd edition, (classic)
2. Instructor prepared materials