

**WWTR 124 Course Outline as of Fall 2019****CATALOG INFORMATION**

Dept and Nbr: WWTR 124 Title: PUMPS AND MOTORS

Full Title: Pumps and Motors

Last Reviewed: 8/27/2018

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.75	17.5	Lecture Scheduled	48.13
Minimum	3.00	Lab Scheduled	0.75	4	Lab Scheduled	13.13
		Contact DHR	0		Contact DHR	0
		Contact Total	3.50		Contact Total	61.25
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 96.25

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 124

**Catalog Description:**

Basic theory of hydraulics and pumping systems, including operation, troubleshooting, maintenance and repair of pumps and pumping systems.

**Prerequisites/Corequisites:****Recommended Preparation:****Limits on Enrollment:****Schedule of Classes Information:**

Description: Basic theory of hydraulics and pumping systems, including operation, troubleshooting, maintenance and repair of pumps and pumping systems. (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:**

<b>AS Degree:</b>	<b>Area</b>	<b>Effective:</b>	<b>Inactive:</b>
<b>CSU GE:</b>	<b>Transfer Area</b>	<b>Effective:</b>	<b>Inactive:</b>
<b>IGETC:</b>	<b>Transfer Area</b>	<b>Effective:</b>	<b>Inactive:</b>
<b>CSU Transfer:</b>		<b>Effective:</b>	<b>Inactive:</b>
<b>UC Transfer:</b>		<b>Effective:</b>	<b>Inactive:</b>

**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. Describe water system hydraulics and the types and uses of pumps.
2. Perform basic installation, maintenance, troubleshooting, and repair of hydraulic pumps.
3. Describe the electrical control of pumping systems.

### **Objectives:**

At the conclusion of this course, the student should be able to:

1. List main types, features, and uses of hydraulic pumps.
2. Select, install, and maintain pipe, pipe fittings, and valves in water and wastewater systems.
3. Explain the theories related to how various pumps operate.
4. Perform related hydraulic calculations and measurements.
5. Install and operate hydraulic pumps.
6. Describe pump control using Supervisory Control And Data Acquisition (SCADA).
7. Maintain, troubleshoot, and repair hydraulic pumps.
8. Define electrical terms, principles, equations, and safety procedures.
9. Perform electrical calculations and measurements involving power, voltage, amperage, and electrical resistance.
10. Describe the types of motors and starters, their uses, and their principles of operation.
11. Maintain, troubleshoot, and repair electrical motors and starters.
12. Describe pump station operations, maintenance, and safety procedures.

### **Topics and Scope:**

- I. Introduction to Pumps and Hydraulics
  - A. History
  - B. Vocabulary
  - C. Classification and operational differences
    1. Dynamic pumps
    2. Positive displacement pumps
  - D. Applications water and wastewater systems
- II. Piping and Valves

- A. Suction and discharge piping selection and installation
- B. Control valves: types, installation, maintenance, and repair
- C. Sealing and priming of pumping systems
- III. Basic Electronics
  - A. Electrical terms, formulas, and circuits
  - B. Determining power, voltage, amperage and electrical resistance
  - C. Wiring and wiring tools
- IV. Meters and Test Equipment
  - A. Metering equipment
  - B. Amp testing
  - C. Megohmmeter testing
  - D. Testing pressure gauges
- V. Motors and Starters
  - A. Types and uses
  - B. Principles of operation
  - C. Energy optimization and efficiency
  - D. Maintenance and troubleshooting
  - E. Disassembly and repair
- VI. Hydraulics Computations
  - A. Hydraulics theory basics
  - B. Horsepower and efficiency
  - C. Total Dynamic Head (TDH)
  - D. Net Positive Suction Head (NPSH)
  - E. Pump curves
  - F. Affinity laws
    - 1. Impeller trim and speed change effects
    - 2. Capacity, head, and horsepower requirements
- VII. Centrifugal Pumps
  - A. Types, including coupling and drive types
  - B. Principles of operation
  - C. Installation and operation
  - D. Maintenance and troubleshooting
  - E. Disassembly and repair
- VIII. Hydrostatic Pumps
  - A. Types and principles of operation
  - B. Installation and operation
  - C. Maintenance and troubleshooting
  - D. Disassembly and repair
- IX. Pump Station Maintenance and Safety
  - A. Preventive and planned maintenance
  - B. Appropriate intervals and triggers
  - C. General safety procedures

#### Lab Topics and Scope

- I. Electrical meters and measurements
- II. Pressure and flow meters and measurements
- III. Electrical wiring basics
- IV. Pipe and valve assembly, sealing, and priming
- V. Horsepower and efficiency
- VI. Motor and starter maintenance, troubleshooting, disassembly, and repair
- VII. Centrifugal pump maintenance, troubleshooting, disassembly, and repair
- VIII. Hydraulic pump maintenance, troubleshooting, disassembly, and repair

## IX. Pump station overview and field trip

### Assignment:

#### Lecture-related Assignments:

1. Reading assignments (20 pages per week)
2. Problem solving homework assignments (10-15)
3. Quizzes and/or exams (2-15)
4. Final exam
5. Field trip report (3-5 pages)

#### Lab-related Assignments:

1. Lab write-ups (10-15)

### 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  
5 - 10%

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

Homework problems and lab write-ups

Problem solving  
30 - 55%

**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, exams, and final

Exams  
30 - 55%

**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:

- Water Pumps and Pumping Systems, Water/Wastewater Treatment Applications. Rishel, James. McGraw-Hill. 2002 (classic)
- Pumps and Pumping. 8th ed. Arasmith, Skeet. ACR Publication. 2000 (classic)
- Instructor prepared materials