

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Center for Water Studies 134 – Pumps, Motors, & Valves

3 hours lecture, 3 units

Catalog Description

Overview of the basic principles of mechanical equipment design, installation, operation, maintenance, repair, overhaul and replacement. Emphasis on understanding the value of preventative maintenance techniques such as equipment monitoring, lubrication analysis, machine alignment and scheduled overhaul. Preparation for California Water Environment Association (CWEA) Mechanical Technologist Grade 1 and Grade 2 certification exams.

Prerequisite

None

Course Content

- 1) Process Streams - How Liquid Moves
 - a. Hydraulics
 - b. Closed system flows
- 2) Pumps
 - a. Centrifugal pumps
 1. Basic components
 2. Principles of operation
 3. Preventative maintenance
 4. Troubleshooting
 5. Breakdown of maintenance and major overhauls
 - b. Positive displacement pumps
 1. Basic principles
 2. Piston pumps
 - (1) Basic components
 - (2) Principles of operation
 - (3) Preventative maintenance
 - (4) Troubleshooting
 - (5) Breakdown maintenance and major overhauls
 3. Diaphragm pumps
 - (1) Basic types and components
 - (2) Principles of operation
 - (3) Preventative maintenance
 - (4) Troubleshooting
 - (5) Breakdown maintenance and major overhauls
 - c. Progressive cavity, peristaltic, chemical feed and other pumps
 1. Basic types and components
 2. Principles of operation
 3. Preventative maintenance
 4. Troubleshooting
 5. Breakdown maintenance and major overhauls
- 3) Motors
 - a. Primary power sources: electric, internal combustion, pneumatic
 - b. Motor enclosures and controls

- c. Preventative maintenance
 - d. Troubleshooting
 - e. Breakdown maintenance and major overhauls
- 4) Couplings
 - a. Types and purpose
 - b. Alignment
 - 5) Shaft Bearings
 - a. Types and purpose
 - b. Lubrication
 - c. Seals
 - 6) Gear Boxes
 - a. Types and purpose
 - b. Preventative maintenance
 - c. Troubleshooting
 - d. Breakdown maintenance and major overhauls
 - 7) Blowers and Compressors
 - a. Types and purpose
 - b. Preventative maintenance
 - c. Troubleshooting
 - d. Breakdown maintenance and major overhauls
 - 8) Generators
 - a. Types and purpose
 - b. Preventative maintenance
 - c. Troubleshooting
 - d. Breakdown maintenance and major overhauls
 - 9) Valves
 - a. Types and purpose
 - b. Preventative maintenance
 - c. Troubleshooting
 - d. Breakdown maintenance and major overhauls
 - 10) Regulators
 - a. Types and purpose
 - b. Preventative maintenance
 - c. Troubleshooting
 - d. Breakdown maintenance and major overhauls
 - 11) Chemical Feed Equipment
 - a. Chlorinators
 - 1. Types and purpose
 - 2. Preventative maintenance
 - 3. Troubleshooting
 - 4. Breakdown maintenance and major overhauls
 - b. Conveyers, feeders and slakers
 - 1. Types and purpose
 - 2. Preventative maintenance
 - 3. Troubleshooting
 - 4. Breakdown maintenance and major overhauls
 - 12) Process Equipment
 - a. Flocculators
 - b. Flash mixers
 - c. Sludge removal equipment
 - 13) Safety Precautions
 - a. Lock-out tag-out
 - b. Material safety data sheets
 - c. Lifting techniques

- d. Safety guards and similar devices
- e. Personal protective equipment
- f. Employee training

14) Recordkeeping - Importance and accuracy of maintenance records: manual, automated

Course Objectives

Students will be able to:

- 1) Critique construction safety precautions practiced and personal protective equipment used when constructing, inspecting, repairing and maintaining equipment used in the water/wastewater industry.
- 2) Define mechanical terminology as it relates to water/wastewater transmission and treatment equipment.
- 3) Identify major components of common equipment used in the water/wastewater industry.
- 4) Demonstrate knowledge of the pertinent information contained in maintenance manuals including the proper interpretation of charts and graphs.
- 5) Describe in detail preventative maintenance required for each major class of equipment.
- 6) Identify the location and correctly interpret the meaning of information provided on a Material Safety Data Sheet.
- 7) Demonstrate knowledge of how oils and lubricants are properly selected, used and evaluated for performance.
- 8) Describe the benefits and general application of machine alignment techniques.
- 9) Successfully pass CWEA Mechanical Technologist Grade 1 and Grade 2 certification exams.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

- 1) Projects
- 2) Writing assignments
- 3) Exams & quizzes
- 4) Homework assignments
- 5) Projects and assignments utilizing the Field Operations Skills Yard

Special Materials Required of Student

None

Minimum Instructional Facilities

Smart classroom

Method of Instruction

- 1) Lecture and discussion
- 2) Audiovisual
- 3) Cutaway models
- 4) Field trips
- 5) Demonstrations utilizing the Field Operations Skills Yard

Out-of-Class Assignments

- 1) Reading assignments
- 2) Writing assignments
- 3) Projects

Texts and References

- 1) Required (representative examples):

- a. *Small Wastewater System Operation and Maintenance, Volume 1*. Second Edition. California State University, Sacramento Office of Water Programs. 2012.
 - b. *Water Pollution Control Federation Wastewater Treatment-Pumps: Operation and Maintenance (Student Workbook)*. Water Pollution Control Federation, 1997.
- 2) Supplemental: Arasmith, E. E. "Skeet". *Pumps & Pumping*. 10th edition. The ACR Publications, Inc., 2010.

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- 1) Identify major components of common pumping equipment used in the water/wastewater industry.
- 2) Define preventative maintenance and explain how it benefits each major class of equipment.
- 3) Identify steps involved in identifying and diagnosing equipment malfunctions.
- 4) Compare and contrast the function of a variety of sensing devices (e.g., heat sensor, machine alignment, vibration monitors and pressure gauges).