



A Non-Profit Educational Corporation

## OCT WATER QUALITY ACADEMY A U.S. Government Education Contractor

ONLINE Class Description submittal to OESAC

Title: **Pumps & Motors**

New Class

Distance Education

CEU Award requested: **0.6 CEUs**

### **ONLINE CLASS OVERVIEW:**

The focus of the class is on the theory and operation of kinetic energy centrifugal pumps. It is an intensive introduction and practical application review on the basic operation of centrifugal pumps and their application in the water industry. During the course of the presentation, the student will learn the centrifugal pump types, centrifugal pump components, fundamentals of pump hydraulics, pump NPSH and cavitation, pump curves, safety, and troubleshooting.

This class is the updated and revised version of previously OESAC approved course 3959.

### **OESAC ACCESS:**

A state username has been created for evaluation purposes. To access class, please visit:

<https://elearning.octwqa.org/>

Username: oregon@octinc.com

Password: W@t3rCl@ss3s

Name: oregon elearner

Email: [oregon@octinc.com](mailto:oregon@octinc.com)

### **CLASS DESCRIPTION:**

Upon completion of this course, learner will know about:

- Positive displacement, kinetic pumps and pump types
- Pump casing, impeller, shaft and sleeves
- Basics of water pumping, hydraulics, design parameters and criteria
- Cavitation, bubbles formation and collapse

- Centrifugal pumps concept and theory
- Reciprocating, rotary, centrifugal and specialty pumps
- Types of mechanical and packing seals
- Minimum, maximum and nominal pumping rates
- Pumping rates, friction loss and total pump head
- Protective gear like gloves, goggles, aprons, and respirators
- Suction air leaks, clogging, wearing of gaskets and seals

**OUTLINE:**

All eLearning classes are self-pacing so the learner can log on at will to continue working on the class content. It is not necessary to complete all chapters in one session. The operator will have up to *90 days* from the date of enrollment to complete all class chapters and quizzes.

<b>Chapter Title:</b>	<b>Time</b>
1. Introduction to Centrifugal Pumps	45 minutes
2. Centrifugal Pump Types	45 minutes
3. Centrifugal Pump Components	45 minutes
4. Fundamentals of Pump Hydraulics	45 minutes
5. Pumps NPSH and Cavitation	45 minutes
6. Building Pump Curves	45 minutes
7. Pump Safety	45 minutes
8. Pump Troubleshooting	45 minutes
<b>Total:</b>	6 hours

**EXAMINATION PROCESS:**

Each chapter includes a comprehensive quiz which must be taken after completion of the chapter content. The Learning Management System (LMS) does not allow learners to skip ahead through the material. To earn a passing grade on each quiz, the learner must correctly answer at least 70% of the questions. This also ensures learners are spending adequate time going through materials and comprehending the curriculum. If necessary, all quizzes can be re-taken once in an effort to improve the score but learners will need to start that chapter from the beginning. An average score of 70% is required to receive credit for the class.

**Time for Completion, per chapter:**

Each chapter is designed to take 40 – 60 minutes to complete following a voice over narrative and time paced format. The end of chapter measure quiz is expected to take

approximately 10 – 20 minutes to complete. We adjusted the outline to be closer to 45 minutes per chapter because that's what beta testing has proven.

### **DETAILED SUPPORTING DESCRIPTION:**

#### Chapter 1: Introduction to Centrifugal Pumps

- Learn about...Positive displacement and kinetic pumps
- Know about...Centrifugal pumps concept and theory
- Discuss...Pump casing, inlet and outlet, seal chamber and bearings
- Analyze...Pump moving parts like impeller and shaft
- Grasp...Axial, radial and mixed flow pump configurations
- Contemplate upon...Volute and diffuser type enclosures
- Overview...Pump head, flow, cavitation and efficiencies
- Review...Drawbacks and advantages of the centrifugal pumps

#### Chapter 2: Centrifugal Pump Types

- Learn about...Positive displacement and kinetic pump types
- Know about...Reciprocating, rotary, centrifugal and specialty pumps
- Discuss... Radial, Axial and Mixed Flow Centrifugal Pumps
- Analyze... Single and Double Suction Centrifugal Pumps
- Grasp... Closed, Open and Semi-Open Impeller Types
- Contemplate upon... Volute and Diffuser Type Pumps
- Overview... Single and Multi-Stage Centrifugal Pump Types
- Review...Submersible and Turbine Centrifugal Pumps

#### Chapter 3: Centrifugal Pump Components

- Learn about...Pump casing, impeller, shaft and sleeves
- Know about... Types of mechanical and packing seals
- Discuss...Bearings, bearing housing and failure causes
- Analyze...Motor selection, horse power needs, VFDs
- Grasp...Pump package assemblies and installation aspects
- Contemplate upon...Importance of base plates and soleplates

- Overview... Pump foundation and grouting considerations
- Review...Pipe supports, anchors and structural loads

#### Chapter 4: Fundamentals of Pump Hydraulics

- Learn about...Basics of water pumping and hydraulics
- Know about...Minimum, maximum and nominal pumping rates
- Discuss...Various types of flowmeters used for measurements
- Analyze...Static head and net positive suction head concepts
- Grasp... Minor and major dynamic head losses
- Contemplate upon...Hazen-Williams and Darcy-Weisbach equations
- Overview... Hydraulic grade lines and energy grade lines
- Review...Energy requirements, power requirements, operating costs

#### Chapter 5: Pumps NPSH and Cavitation

- Learn about...Basics of water pumping and design parameters
- Know about...Pumping rates, friction loss and total pump head
- Discuss... NPSH available and NPSH required
- Analyze...Atmospheric pressure variations with elevation
- Understand... Maximum static suction lift and water vapor characteristics
- Learn about ...Cavitation, bubbles formation and collapse
- Overview... Suction cavitation and discharge cavitation
- Review...Cavitation damages, detection techniques and remedies

#### Chapter 6: Building Pump Curves

- Learn about...Basics of water pumping and design criteria
- Know about...Pumping rates, friction loss and total pump head
- Discuss...Pump affinity laws and governing equations
- Analyze...Pump curves development process and its components
- Grasp...Shutoff head and pump impeller rim velocity
- Consider...The effect of impeller size and speed on pump curves
- Overview...Suction speed and suction specific speed

- Review... Pump efficiency, horsepower, NPSH and system curves

#### Chapter 7: Pump Safety

- Learn about...Basics of water pumping and safety measures
- Know about...Protective gears like gloves, goggles, apron, respirators
- Discuss...Safety symbols, warnings, cautions and notices
- Grasp...Safe handling, dismantling, operating and maintaining pumps
- Analyze...Pump installation, lifting, alignment related safety aspects
- Contemplate upon...Accidents, explosions, hazards, health risks
- Overview...Electrical codes, shocks, precautionary measures
- Review...Explosion proof equipment, sound enclosures, lift stations

#### Chapter 8: Pump Troubleshooting

- Learn about...Basics of water pumping and troubleshooting measures
- Know about...Suction air leaks, clogging, wearing of gaskets and seals
- Discuss...Reverse rotation of impellers and impact on pump priming
- Grasp... Suction line submergence, entrance velocity, air entrainment
- Analyze...**Good and poor suction and discharge side piping practices**
- Contemplate upon...**Low flows, valve plugging, high heads, suction lifts**
- Overview...**Belt drives, drive coupling arrangements, overloading**
- Review...Bearing failures, pump noise, vibration levels, motor life

END