

SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION, MANUFACTURING AND TECHNOLOGY DIVISION
Energy Generation Operations Technology Program
Revision Date: August 24, 2020

I. CATALOG DESCRIPTION

Course Number: ENER1115
Course Title: Mechanical and Fluid Fundamentals
Prerequisite(s): None
Catalog Description: This course will give the student a basic understanding of pumps, valves, compressors, and heat exchangers. It will explain the proper procedure on how to start, operate and shut down pumps. Common inspection and maintenance practices, as well as common operating problems of centrifugal pumps will be discussed. Functions and characteristics of reboilers, cooling towers, refrigeration theory and principles will be covered in detail. Lab must be taken concurrently.

Credit Hours: 3.0
Class Hours: 38
Lab Hours: 23
Total Contact Hours: 61

II. COURSE OBJECTIVES: *Course will:*

- A. Familiarize students with the basic equipment and technology associated with a typical process system.
- B. Provide students with an in-depth knowledge of the purpose, design and theory of process equipment.
- C. Introduce various associated components and their relationship to plant systems.
- D. Provide opportunities for students to handle various products, tools and equipment that are used in the process industry.
- E. Explain the operation of the various components and equipment.
- F. Describe the inspection and maintenance responsibilities of the operator.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Discuss the purpose and use of basic hand tools.
 - 2. Understand the purpose of checklists.
 - 3. Identify and describe the purpose of piping systems and associated fittings.
 - 4. Explain why and how pipe movement needs to be controlled.
 - 5. Identify tanks and vessels and their use.
 - 6. Explain the design, purpose, and function of common valves, actuators, pumps, and compressor systems.
 - 7. Identify and describe the design, principles and operation of common heat exchangers.
- B. General Education Learning Outcomes (GELOs)
 - 1. GELO #3: Critical Thinking & Problem Solving
 - Outcome 5: Acquire and integrate knowledge and construct relationships across disciplines.

IV. CONTENT/TOPICAL OUTLINE

- A. Basic Hand Tools

1. Wrenches
2. Pliers
3. Screwdrivers
4. Ratchet and socket sets
5. Checklists
6. Basic P & ID symbols
- B.** Piping and Auxiliaries
 1. Basic Components and Functions
 2. System Components and Operation
 3. Tanks and Vessels
- C.** Material Handling
 1. Tank trucks
- D.** Equipment Drive Components
 1. Couplings
 2. Gear, Belt and Chain Drives
- E.** Equipment Lubrication
 1. Lubricants and Bearings
 2. Using Lubricants
- F.** Valves
 1. Design and Function
 - a. Globe
 - b. Gate
 - c. Ball
 - d. Butterfly
 - e. Diaphragm
 - f. Check
 - g. Relief
 - h. Safety
 2. Steam Traps
 - a. Inverted Bucket
 - b. Float
 - c. Thermostatic
 3. Maintenance and Operation
 4. Introduction to Actuators
 - a. Solenoid
 - b. Hydraulic
 - c. Pneumatic
 1. Diaphragm
 2. Piston
 3. Vane
- G.** Pumps
 1. Basic Types and Operation
 2. Performance and Inspection
 3. Rotary Positive Displacement Types
 4. Fundamentals of Centrifugal Types
 5. Operation of Centrifugal Types
- H.** Compressors
 1. Dynamic Displacement
 2. Positive Displacement
 3. Single and Multistage Application
 4. Parallel and Double-Acting Arrangement

- 5. Maintenance and Operation
- I. Heat Exchangers
 - 1. Introduction
 - a. Double-pass
 - b. Thermosiphon Reboiler
 - c. Kettle Reboiler
 - d. Condenser
 - e. Single pass Fixed Head
 - f. Multi-pass Fixed Head
 - g. Mutli-pass Floating Head
 - h. Plate and Frame
 - i. Air Cooled Fin Fan
 - 2. Heat Exchanger Maintenance and Inspection
 - 3. Cooling Towers
 - a. Atmospheric
 - b. Natural Draft
 - c. Forced Draft
 - d. Induced Draft
 - e. Hyperbolic
 - f. Cross-Flow
 - g. Counter-Flow
 - 4. Cooling Tower Operation and Maintenance
- J. Furnaces
 - 1. Introduction
 - a. Combustion
 - b. Electric
 - 2. Startup and Shutdown
 - 3. Operating Conditions
- K. Refrigeration System
 - 1. Basic Concepts
 - 2. Simple System Components
 - 3. Operation

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s): Thomas, Charles E., *Process Technology Equipment & Systems*, 3rd Edition, ISBN-13: 978-1-4354-9912-6
- B. Other Resources: High Speed Internet Access and Required On-Line Modules

VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
 - 1. Hybrid Class

VII. METHODS OF EVALUATION

- A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:
 - 1. Class participation
 - 2. Regular assignments
 - 3. Written exams and/or quizzes
 - 4. Performance and observational assessments

VIII. SPECIFIC COURSE REQUIREMENTS

- A. A minimum grade of “C” is required.
- B. **Cheating within the Manufacturing Division:** Any violation of academic integrity on assignments, quizzes, or tests will result in a grade of 0 on that assignment, quiz, or test. A second violation in any course after the initial infraction will result in a grade of F for that course. Any additional violations while in the program will result in a suspension from the program. For additional information, refer to the *Academic Integrity* pamphlet available from Student Services.
- C. **Credit by Examination:** Credit for the course CANNOT be earned through Credit by Examination.