

SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION, MANUFACTURING AND TECHNOLOGY DIVISION
Energy Generation Operations Technology Program
Revision Date: August 26, 2019

I. CATALOG DESCRIPTION

Course Number: ENER2300
Course Title: Coal Plant Operations and Troubleshooting
Prerequisite(s): ENER2120
Catalog Description: Introduction to the general layout and system operations of a typical coal-fueled electric generating plant. Coal-handling systems, emission controls, life-cycle parts monitoring, combustion controls, fire systems, steam, water, air systems and general operations of a coal plant are covered. Troubleshooting scenarios are introduced and practiced. Lab must be taken concurrently.
Credit Hours: 3
Class Hours: 38
Lab Hours: 23
Total Contact Hours: 61

II. COURSE OBJECTIVES: *Course will:*

- A. Introduce the students to the equipment and systems that are used to handle the fuel in a coal-fired electricity generating plant.
- B. Provide theory for and examples of auxiliary systems in a typical coal-fired power plant.
- C. Outline the various condensate and feedwater systems used in a typical coal-fired power plant.
- D. Describe and outline the various air systems utilized in a typical coal-fired power plant.
- E. Describe the steam-generating systems in a typical coal-fired power plant.
- F. Explain how emission control systems work in a typical coal-fired power plant and why they are necessary.
- G. Describe a typical electrical flow diagram for a common coal-fired power plant.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Describe the overall operation of a typical coal-fired power plant.
 - 2. Describe the fundamental operation of coal-fired power plant equipment.
 - 3. Explain the characteristics of Powder River Basin coal.
 - 4. Describe the coal delivery system for a coal-fired power plant.
 - 5. Describe the boiler and air system relationships in a coal-fired power plant.
 - 6. Explain the operational relationships of the circulating water, condensate & feedwater systems in a coal-fired power plant.
 - 7. Explain and draw the steam system from the boiler to the condenser in a coal-fired power plant.
 - 8. Describe the auxiliary systems in a common coal-fired power plant.
 - 9. Sketch and describe the electrical distribution systems and equipment.
 - 10. Explain the significance of the coal-fired power plant environmental systems & controls.
- B. General Education Learning Outcomes (GELOs)
 - 1. GELO #3: Critical Thinking & Problem Solving

Outcome 2: Synthesize information to arrive at reasoned solutions to problems.

IV. CONTENT/TOPICAL OUTLINE

- A.** Conventional coal-fired Power Plant Primary Systems
 - 1. Typical coal-fired power plant primary systems
 - 2. Coal-fired Power Plant System Inter-relationships
- B.** Coal Delivery & Handling systems
 - 1. Coal Types and Sources
 - 2. Coal Delivery Methods
 - 3. Outside Coal Handling Systems
 - a. Stacking and Reclaiming Systems
 - b. Conveyors
 - 4. Inside Coal Handling Systems
 - a. Conveyors
 - b. Trippers
 - c. Coal Silos
 - d. Coal Feeders
 - e. Coal Pulverizers (Mills)
 - f. Coal Burners
- C.** Auxiliary Systems
 - 1. Lube Oil Supply and Transfer Systems
 - 2. Station Compressed Air Systems
 - 3. Auxiliary Boilers
 - 4. Drains and Sumps
 - 5. Hydraulic Control Systems
 - 6. Turning Gear Systems
 - 7. Seal Oil Systems
 - 8. Steam Seal Systems
 - 9. Generator Hydrogen Cooling System
- D.** Water Systems & Equipment
 - 1. Circulating Water Systems
 - 2. Condensate Water Systems
 - 3. Feedwater Systems
 - 4. Pumps and Valves
 - 5. Pre-Heaters
 - 6. Cooling Towers and River Systems
- E.** Air Handling Systems
 - 1. Primary Air Systems
 - 2. Secondary (Combustion) Air Systems
 - 3. Tertiary Air Systems
 - 4. Forced Draft (FD) Blowers
 - 5. Induced Draft (ID) Blowers
 - 6. Balanced Draft Systems
- F.** Steam Systems
 - 1. High Pressure Boiler Construction
 - 2. Steam Drums
 - 3. Steam System Safety
 - 4. Downcomers
 - 5. Superheaters
 - 6. De-Superheaters (Attemperators)

- 7. Extraction Steam
- 8. Steam Turbines
- 9. Hydraulic Controlled Steam Valves
 - a. Stop Valves
 - b. Throttle Valves
 - c. Governor Valve
- G. Emission Control Systems
 - 1. SO₂, NO_x, Mercury, CO₂ and Particulate Controls
 - 2. Fabric Filters (Baghouses)
 - 3. Electrostatic Precipitators
 - 4. SCR (Selective Catalytic Reduction) Systems
 - 5. SDA (Spray Dry Absorber) Systems
 - 6. Activated Carbon Injection Systems
 - 7. Bottom Ash Systems
 - 8. Fly Ash Systems
 - 9. EPA Requirements
- H. Electrical Systems
 - 1. Generators
 - 2. Transformers
 - 3. Emergency and Backup Power Systems
 - 4. Plant House Electrical Systems
 - a. 480 Volt Systems
 - b. 4160 Volt Systems
 - c. 13.8kvolt Systems
 - d. DC Systems
 - 5. Motor Control Centers (MCC)

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s): Howlett, II, H. C., *The Industrial Operators Handbook*, Thomas, Charles E., *Process Technology Equipment & Systems*, 4th Edition, ISBN-13: 978-1-4354-9912-6 and online reading materials
- B. Other Resources: Plant visits and the Internet
- C. Outside Reading/Research required: Internet Research assignments as assigned
- D. Supplies: As assigned

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" or 70% is required to receive credit for this course.

- 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.