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

I. CATALOG DESCRIPTION

Course Number:	ENER2400
Course Title	Gas Turbines and HRSG Systems
Prerequisite(s):	None
Catalog Description:	This course introduces students to the various types of gas turbine generating systems such as micro, heavy frame and aero-derivative systems. Various topics include theory of operation, fuel systems, emission controls, inlet systems, cooling, heating, and filtering. History of gas turbines is covered as well as support systems, combustion controls, life-cycle monitoring and safety in a gas turbine plant. Students will also be introduced to HRSG (Heat Recovery Steam Generator) topics including purge sequences, co-generation systems, single and multiple steam drums, duct burners, exhaust gas dynamics, turbulence and emission controls. Lab must be taken concurrently.
Credit Hours:	2
Class Hours:	23
Lab Hours:	23
Total Contact Hours:	46

II. COURSE OBJECTIVES: *Course will*

- **A.** Introduce students to industrial gas turbines and combined cycle operations.
- **B.** Provide opportunities to explore advantages and disadvantages of gas turbine powered electric generating facilities as compared with other fossil-fueled plants.
- **C.** Provide an operator's perspective of various key elements in the primary engines and auxiliary systems typically found in a combined cycle facility.
- **D.** Provide extensive control room operation experience in our simulator.
- **E.** Demonstrate numerous operational and troubleshooting scenarios.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

A. Student Learning Outcomes: *Student will be able to*

1. Describe how heavy frame and aero-derivative gas turbines are constructed.
2. List the auxiliary support systems that are common to all gas turbines and describe the basic operation of each.
3. Describe the thermal efficiency of gas turbine power plants vs. a conventional steam turbine power plant.
4. Explain the basic design of single and multi-shaft arrangements on gas turbine engines.
5. Describe the design, construction and operation of gas turbine compressor sections.
6. Define Cogeneration and ways it can be achieved.
7. Identify major components of a HRSG including the normal flow-path of exhaust gas through the diverter and bypass stack, duct burners, HP section, LP section, SCR bed and exhaust stack.

B. General Education Learning Outcomes (GELOs)

1. GELO #3: Critical Thinking & Problem Solving
Outcomes 1: Collect, identify, interpret and analyze data.

IV. CONTENT/TOPICAL OUTLINE

A. Introduction to Industrial Gas Turbines
- **1.** History of Gas Turbines
- **2.** Early Industrial Gas Turbine Design (Laws and Principles)
- **3.** Basic Gas Turbine Design
- **4.** Brayton Cycle explanation

B. Gas Turbine Engine Components
- **1.** Gas Turbine designs
- **2.** Components common to all gas turbines
- **3.** Gas Turbine inlet compressor designs
- **4.** Gas Turbine combustor designs
- **5.** Temperature/Pressure profile explanation
- **6.** Gas Turbine Shaft arrangements
- **7.** Gas Turbine reduction gears

C. Gas Turbine Support Systems
- **1.** Gas Turbine Engine Fuel System
- **2.** Gas Turbine Starting Systems
- **3.** Gas Turbine Bearings and Lubrication Systems
- **4.** Gas Turbine Air Intake System

D. Gas Turbine Engine Control Systems

E. Gas Turbine Protection Systems

F. Gas Turbine Open and Closed Cycle designs

G. Cogeneration, Design and Major Components
- **1.** Generation of "Waste Heat"
- **2.** Extraction Steam (sources and uses)
- **3.** Types of typical plant design

H. Cogeneration Plant Load Demand and Control
- **1.** Effects of changing power of co-gen units on waste heat production
- **2.** Effects of changing waste heat demand on co-gen power engines

I. HRSG Design and construction
- **1.** HRSG Low pressure section
- **2.** HRSG High pressure section
- **3.** HRSG Diverter Design, Construction and Operation
- **4.** HRSG Duct Burner Design, Construction and Operation
- **5.** Complete Steam Cycle using a HRSG for steam production

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: Internet and classroom activities

C. Outside Reading/Research required: Internet Research assignments

D. Supplies: 3-ring binder with blank paper for notes and USB Flash Drive

VI. METHODS OF PRESENTATION/INSTRUCTION

A. Methods of presentation typically include a combination of the following:

1. Instructor-led learning activities
2. Assigned research projects
3. Homework assignments
4. Quizzes and tests
5. Control Room Simulator labs

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 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.