

EN 455

Plant Systems & Environmental Protection

1 Credit

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Plant Systems & Environmental Protection

Calendar Description

Components of power plant systems such as feed water, steam piping, fuel, condensate, cooling water systems, waste handling and their integration are studied. Environmental protection including monitoring and control of various pollutants such as SO_x, NO_x and fine particle are part of this course. Advanced topics in measuring of stack emissions and waste water pollution are also important parts of the course.

Rationale

This course has been developed to support students seeking to further their careers, as Second Class Power Engineers, with an ever increasing industry demand to replace retiring Power Engineers and operate new facilities.

Industry has shifted their focus from employing the 4th and 3rd class levels of Power Engineering certification to higher levels of certification.

Upon successful completion of this program the student is eligible for a 9 month reduction in qualifying time experience granted by ABSA.

The six parts of the program are divided into 15 courses where the student has the option of registering for individual courses, Part A, Part B, or both Part A and Part B.

Prerequisites

EN 310, EN 320, EN 410, EN 420, or Third Class Power Engineer's Certificate of Competency

Co-Requisites

None

Course Learning Outcomes

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

1. explain the significance of the following air quality parameters: particulates, stack opacity, SO₂ concentration, SO₂ mass flow, NO_x concentration, NO_x mass flow, mercury, O₂, CO₂, and hydrocarbons.
2. explain the basic principles of operation for Continuous Emissions Monitoring Systems (CEMS).
3. explain the general requirements for Continuous Emissions Monitoring Systems (CEMS).
4. explain the significance of the following water quality parameters: iron, phosphorous, biological oxygen demand (BOD), chemical oxygen demand (COD), hydrocarbons, temperature, flow, pH, and nitrogen.
5. explain the general requirements for wastewater monitoring.
6. explain how data that is received from environmental monitoring equipment is interpreted.
7. explain the significance of environmental equipment failure.
8. describe the procedures used for troubleshooting environmental monitoring equipment.
9. describe the purpose, design, operation, and application of Flue Gas Desulphurization (FGD) systems.
10. describe the purpose, design, operation, and application of Selective Catalytic Reduction (SCR) systems.
11. explain the significance of NO_x reduction in a power plant, and the procedures and equipment used to reduce NO₂ emission from a boiler and from a gas turbine.
12. explain the purpose, effects, and application of flue gas chemical conditioning in a power plant.
13. explain the significance, procedures, and equipment for reduction of CO₂ emission from a boiler.
14. describe the purpose, design, operation, and application of a baghouse.
15. describe the purpose, design, operation, and application of an electrostatic precipitator.

Resource Materials

Required Text:

Power Engineering Second Class (2015) B-2 Combustion and Plant Systems (2nd ed.).

Calgary, AB: PanGlobal Training Systems Ltd.

NOTE: Additional resource material is provided or accessed through D2L

Conduct of Course

This course follows the syllabus as set out by the Standardization of Power Engineer's Examination Committee (SOPEEC) and the curriculum recommended by the Interprovincial Power Engineer Curriculum Committee (IPECC).

This course builds on the student knowledge gained through the Fourth Class and Third Class Power Engineering courses.

This course is delivered face to face with a component of online directed study, and includes class lectures, group discussions, demonstrations, assignments, and projects.

Cutaway models, videos, and actual equipment may be used to support instruction and demonstrations.

Desire2learn (D2L) is an online course management suite and is used as an educational resource for tracking attendance, administering quizzes, and reporting grades. Students will access D2L directly, from any computer, and may view their progress, grades and attendance at any time.

This course consists of four chapters. There is an exam at the end of each chapter as well as a midterm and final exam.

The exams consist of seven written questions of which the student chooses five questions to answer. Each question is worth 20 marks and partial marks are awarded for correct methods and partial answers.

Evaluation Procedures

Lakeland College is committed to the highest academic standards. Students are expected to be familiar with Lakeland College policies related to academic conduct and academic honesty and to abide by these policies.

The marking scheme for this course is:

| | |
|--------------------------|-----|
| Assignments and Projects | 20% |
| Chapter Exams | 20% |
| Midterm Exam | 30% |
| Final Exam | 30% |

The lectures and dates of exams are determined in class.

Examinations contain long answer written type questions.

A minimum grade of 65% is required to pass this course.

A GRADE OF AT LEAST 50% IS REQUIRED ON THE FINAL EXAM TO PASS THIS COURSE.

Those students seeking a qualifying time reduction must achieve a grade of 65% for sections A-1, A-2, A-3, B-1, B-2, B-3 and maintain at least 80% attendance in the program.

Students receive a certificate from Lakeland College indicating successful completion of the program.

NOTE: This program consists of six components; each component corresponds to one examination paper of the SOPEEC examination process.

The requirements for a second class power engineer consist of six examinations and 30 months of qualifying industry experience, with the exception of a 9 month credit for completion of all courses in the program.

Grade Equivalents and Course Pass Requirements

A minimum grade of C+ (65%) is required to pass this course.

| Letter | F | C+ | B- | B | B+ | A- | A | A+ |
|---------------|------|-------|-------|-------|-------|-------|-------|--------|
| Percent Range | 0-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85-89 | 90-94 | 95-100 |
| Points | 0.00 | 2.30 | 2.70 | 3.00 | 3.30 | 3.70 | 4.00 | 4.00 |

Attendance

For those students seeking the nine (9) month experience qualifying time reduction granted by ABSA, a minimum attendance of 80% in all courses is required, as per the Student Handbook. If the experience credit is not desired, there is no mandatory attendance requirement.

Course Units/Topics

Environmental Monitoring

(Explain the significance of environmental parameters and methods of monitoring)

Environmental Control Methods

(Explain the methods used to remove SO₂, NO_x, CO₂, and particulates from boiler flue gases)

