EN 339

Refrigeration & Compression

3 Credits

Instructor: Russ Webb
780 871 5484
Original Developer: Doug Stelmack
Current Developer: Russ Webb
Reviewer: Robert Collins
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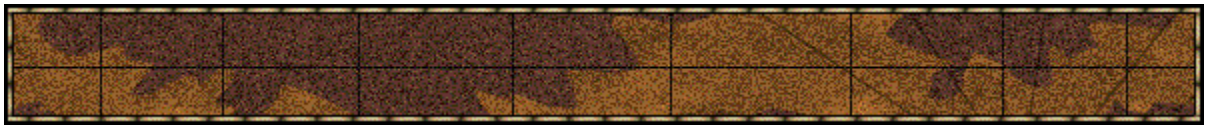

Refrigeration & Compression

Calendar Description

There are two components in this course. The air and gas compression component deals with the theory of compression, various types of air compressors and auxiliary equipment. The refrigeration component includes the theory of refrigeration, capacities and performance, refrigeration cycles, safety and control, and equipment. Different types of refrigeration plants including compression and absorption systems and their operations are examined.

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. describe the design and application of compressors including a selection of prime movers.
2. describe the design of reciprocating compressors.
3. describe the design of rotary compressors.
4. describe the design of centrifugal and axial compressors.
5. describe the types and operation of coolers and air dryers including types of desiccants.
6. describe the installation of a compressed air system showing all ancillary equipment including typical instrumentation.
7. describe the regulation and control of compressors.
8. describe the monitoring and protection devices for a compressed air system.
9. explain the effects of altitude, air temperature, and humidity on air compressor performance.
10. describe the monitoring, troubleshooting, and typical preventative maintenance for a compressed air system.
11. describe the types of refrigerants.
12. describe the principles and operation of vapour compression refrigeration systems.
13. describe the principles and operation of absorption refrigeration systems.
14. describe the principles and operation of multi-stage and cascade refrigeration systems.
15. describe the principles, applications, and operation of heat pump and thermoelectric systems.
16. describe the design of hermetic refrigeration systems.
17. describe the design and operation of refrigeration compressors.
18. describe the design and operation of evaporators, condensers, receivers, scale traps and dehydrators.
19. describe the design and operation of absorbers.
20. describe the design and operation of valves and fittings.
21. describe the codes and standards which apply to the design, installation, and operation of a refrigeration plant.
22. describe the purpose and operation of the various operating, actuating, limiting and safety controls used in refrigeration systems.
23. explain refrigeration metering devices.
24. explain evaporator and compressor capacity controls.
25. describe the detailed startup and shutdown procedures for a refrigeration system.
26. explain absorption system startup and shutdown.
27. explain leak testing, charging, purging and compressor lubrication.
28. describe the common operating problems and troubleshooting procedures for a refrigeration system.
29. describe the general refrigeration cycle and the application of the Carnot cycle.
30. describe the relationship between enthalpy and pressure for a refrigeration cycle.
31. define and calculate the refrigerating effect and the mass of refrigerant circulated.
32. calculate the coefficient of performance for a refrigeration system.
33. calculate the capacity of a refrigeration machine.

34. calculate the theoretical power of a refrigeration compressor.
35. calculate the theoretical bore and stroke of a refrigeration compressor.

Resource Materials

Required Text:

Power Engineering Second Class (2015) B-3 Electricity and Refrigeration (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

Air and Gas Compression

(Explain the design and operation of gas compressors and compressed air systems)

Refrigeration systems and Equipment

(Explain the construction and operation of refrigeration systems)

Refrigeration Safety, Control and Operation

(Explain the procedures, standards, instrumentation, and controls for a refrigeration system)

Refrigeration Calculations

(Perform refrigeration system calculations)

2602 - 59 Avenue, Lloydminster, Alberta, Canada T9V 3N7. Ph: 780 871 5700
5707 College Drive, Vermilion, Alberta, Canada T9X 1K5. Ph: 780 853 8400
Toll-free in Canada: 1 800 661 6490. Email: admissions@lakelandcollege.ca