EN 340

Thermodynamics

5 Credits

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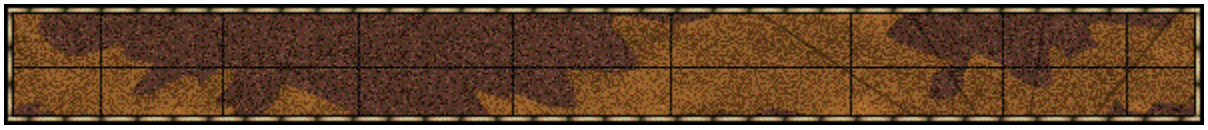

Thermodynamics

Calendar Description

This is an advanced course on topics such as heat transfer, expansions and the work associated with heat, and thermodynamics of steam which includes steam tables, enthalpy, entropy and charts and diagrams. Heat cycles and energy flows are also studied.

Rationale

This course has been developed to fill the gap of Second Class Power Engineers created by the generation of retiring power engineers.

Industry is shifting their focus from employing the lower level certification of power engineer to the higher levels of certification.

Upon successful completion of the Second Class Program the student is eligible for a 9 month qualifying time reduction granted by ABSA.

The six parts of the program are divided into 15 courses. Students have 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. solve engineering problems by applying the principles of:
    a. Ratio and proportion
    b. Algebraic equations including quadratic equations
    c. Power, roots and logarithms

   d. Trigonometry
   e. Geometry
2. calculate the energy content and temperature of substances in mixtures of solids, liquids and vapors.
3. calculate the expansion of solids and liquids due to heat.
4. calculate heat transfer through composite materials including liquid and gaseous films.
5. calculate heat transfer by radiation.
6. explain the behaviours of a perfect gas and the laws that govern gas behaviour.
7. explain Dalton's Law of Partial Pressures.
8. define and calculate specific heats under constant volume and constant pressure conditions.
9. explain the relationship between work and heat.
10. calculate the work done during expansion and compression under constant pressure, isothermal, adiabatic and polytropic conditions.
11. describe the basic properties of water and steam.
12. perform calculations involving specific enthalpy, dryness fraction, specific heat and specific volume using steam tables.
13. explain the principles and use of calorimeters to measure the dryness fraction of wet steam.
14. calculate the dryness fraction of steam based on calorimeter data.
15. calculate the internal energy of steam under given conditions.
16. explain entropy and calculate the change in entropy for a particular water/steam process.
17. determine steam properties using a Mollier Chartcalculate boiler thermal efficiency using test data.
18. determine efficiency, equivalent evaporation, and factor of evaporation for a boiler.
19. describe thermodynamic cycles using pressure-volume and temperature-entropy diagrams and calculate thermal efficiency for each.
20. calculate the heat balance at different points in a Rankine cycle using test data provided.

Resource Materials

Required Text:

This is material that the student is required to have to complete the course:

Power Engineering Second Class A-2 Thermodynamics and Metallurgy (Edition 2.5 with Addenda is recommended but student can complete most of the course topics with Edition 2.0.)

Calgary, AB: PanGlobal Training Systems Ltd.

Reeds Marine Engineering and Technology Volume 3, Applied Thermodynamics for Marine Engineers. Revised by P. A. Russel, W. Embleton, L. Jackson. (4th or 5th ed.). Adlard Coles Nautical.

Recommended Material:

This is material that can be used to supplement the instruction but is not required to complete the course. It can be purchased online or borrowed from the college library:

Reeds Marine Engineering and Technology Volume 1, Mathematics for Marine Engineers.

Revised by K. Conner, L. Jackson, W. Embleton. (8th ed.). Adlard Coles Nautical.

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 courses.

This course is delivered in a blended format through the D2L online platform. Lectures are pre-recorded videos with examples and practice questions. Where applicable, video clips are used to support the instruction. In-class sessions are used to reinforce the lessons taught online.

Each topic has online assessments in the form of quizzes, hand-in assignments and a series of online Unit Tests. A closed book Final Exam is administered at the end of the course.

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:

	MATH	THERMO	TOTAL
Assignments		15%	15%
Quizzes	5%	15%	20%
Unit Tests	5%	30%	35%
Final Exam		30%	30%
Total	10%	90%	100%

The contents and dates of these assessments are detailed in the course syllabus.

Marks are deducted for late assignments and quizzes. A grade of zero is assigned to missed tests and exams.

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

The Final exam for this course is a part of a combined 2A2 Final Exam for the semester. Thermodynamics accounts for 60% of the grade for the combined Final Exam.

A minimum grade of 50% is required on the Final Exam to pass this course.

Students seeking a qualifying time reduction from ABSA must obtain a passing grade for each course in this program, and must satisfy the 80% attendance requirement.

Students may receive a certificate from Lakeland College without the attendance requirement, but they will not qualify for steam time reduction.

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

As a blended delivery course, attendance consists of the completion of all the online components. This includes viewing the recorded lessons and completing the assignments and tests.

In order to be successful in this course, the student should complete all the online components, but in order to obtain qualifying time reduction through ABSA, the student must complete a minimum of 80% of all the online components.

In-class sessions are used to reinforce the concepts taught in the online portion of the course. Attendance for these sessions is recommended, but not part of the attendance requirement for qualifying time reduction.

Course Units/Topics

Mathematics Review for 2nd Class Thermodynamics

(Solve engineering problems using mathematics.)

Thermodynamics of Gases

(Perform calculations related to expansion and compression of perfect gases)

Thermodynamics of Steam

(Perform calculations related to properties of Steam)

Practical Thermodynamic Cycles

(Explain the concepts and use of thermodynamic cycles using pressure-volume and temperature-entropy diagrams)

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