ENGR 251
Thermodynamics I
Fall 2023

Important Note: *This course outline is common to all Fall/Winter/Summer ENGR 251 sections*

Course Instructor: Dr. Lyes Kadem, ing
e-mail: lyes.kadem@concordia.ca (The subject line must be: ENGR251)

Office Hours: Tuesdays and Thursdays 5:00 -6:00 pm at EV003.282
Note 1: Outside office hours, just bring some chocolate ;-)
Note 2: Do not even think about getting the chocolate from a Dollarstore!

Tutorials: Please see your class schedule for details
Tutors:
FA: Mr. Robert Oniga
FB: Ms. Clara Scattolin

Course Calendar Description: Basic principles of thermodynamics and their application to various systems composed of pure substances and their homogeneous non-reactive mixtures. Simple power production and utilization cycles.

Lectures: three hours per week. Tutorial: two hours per week.

Prerequisites: MATH 203 (CEGEP Mathematics 103)
Co-requisites: N/A
Note: This course is a prerequisite to BLDG 365 (Building Science), MECH 351 (Thermodynamics II), ENGR 361 (Fluid Mechanics I)

Specific Knowledge and Skills Needed for this Course:
Students taking this course are expected to have sufficient knowledge of the following topics. Should you have difficulties in any of these topics, you are strongly encouraged to review them before the DNE deadline.

- Basic integration for calculus; Basic differentiation; Basic knowledge in numerical interpolation.

The knowledge base for engineering required for this course will be tested during Quiz I.

Course materials
Required Textbook: N/A
Suggested Textbook: *Thermodynamics: An Engineering Approach,* by Y.A. Çengel and M.A. Boles, Any edition, McGraw Hill.
Additional References (Any edition):
- *Fundamentals of Thermodynamics*, by R.E. Sonntag, C. Borgakke, and G.J. Van Wylen, Wiley.
- *Thermodynamics*, by K. Wark, McGraw Hill.
- *Fundamentals of Engineering Thermodynamics*, by M.J. Moran and H.N. Shapiro, Wiley.

Instructor's Lecture Materials: Course materials and a problem pack can be freely downloaded from the course website. Because buying a textbook at $300 is unsustainable and this is against the laws of thermodynamics, all course notes can be downloaded from the course website:
https://users.encs.concordia.ca/~kadem/teaching/engr251/
Videos for Chapters V and VI:
https://www.youtube.com/watch?v=HsVhTsmFNxg&list=PLNTRu_uCErYEtCqLyLQ7a_1DZ2cFlOiid

Software Use: N/A

Grading Scheme

Evaluation Tool	Other Note/Info	Weight
Quiz	Quiz I (Tentative date: FA (13/09) FB (15/9) in Tutorial)	3.0%
Quiz	Quiz II (Tentative date: FA (4/10) FB (6/10) in Tutorial)	7.5%
Midterm	Midterm Exam (Closed book and notes) (Tentative date: 31/10 in Class)	27%
Quiz	Quiz III: S2S project (Student 2 Student project*) (Submission date: 30/11)	7.5%
Final	Final Exam (Closed book and notes)	55%
Total		100%

- All quizzes and exams: Closed book. Closed notes. GCS Faculty approved calculator only. Electronic communication devices (including cell phones) will not be allowed in examination rooms. ALL exams/quizzes/project are mandatory and ALL exams/quizzes/project will be counted.

- In order to pass the class, both your cumulative score and the final examination must be above 50%

- (*) S2S project: Students will have to record a short video (up to 5 minutes) explaining of the topics listed below. By posting the videos, future students will be exposed to different ways of explaining the same topic (for example, the second law of thermodynamics). This project can be done individually or as a team of maximum **five** members. List of suggested topics: What is thermodynamics?; Properties tables; Phase diagrams; Heat and work; Equation of states; 1st law of thermodynamics; 2nd law of thermodynamics; Gas Power and vapor Cycles; Carnot principle; Entropy.

- There is no fixed relationship between marks and letter grades.

Very Tentative Course Schedule!

Topics	Week
Basic concepts of thermodynamics	1-2
Properties of pure substances	2-4
Energy transfer by heat, work and mass	5
The first law of thermodynamics	6-8
Ideal thermodynamic cycles	9
The second law of thermodynamics	10-12

Disclaimer: In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

Students with disabilities are encouraged to contact the instructor and the Concordia's Access Centre as early as possible in order to efficiently accommodate their needs.

Academic Honesty and Code of Conduct: Violation of the Academic Code of Conduct in any form will be severely dealt with. This includes copying (even with modifications) of program segments. You must demonstrate independent thought through your submitted work. The Academic Code of Conduct of Concordia University is available at:

http://www.concordia.ca/students/academic-integrity/offences.html
http://provost.concordia.ca/academicintegrity/plagiarism/

It is expected that during class discussions and in your written assignments you will communicate constructively and respectfully. Sexist, racist, homophobic, ageist, and ablest expressions will not be tolerated.

Graduate Attributes:
The following is the list of graduate attributes (skills) that students use, learn and/or apply throughout the term.

Graduate Attributes	Indicators	Level of Coverage	Assessment Results Reported
A knowledge base for engineering	○ Knowledge base of natural science	Introductory	Yes
Problem analysis	○ Problem identification and formulation	Introductory	Yes
	○ Problem solving	Introductory	Yes
	○ Analysis (uncertainty and incomplete knowledge)	Introductory	Yes
Communication skills	○ Oral presentation	Introductory	Yes

Course Learning Outcomes (CLOs):
By the end of this semester, students are expected to master the following engineering concepts.

Understand the basic concepts such as change in state, thermodynamic path, cycle, state postulate and thermodynamic scale (zero law of thermodynamics).	**A knowledge base for engineering/** Knowledge-base of natural science
Evaluate the thermodynamic properties of pure substances.	**A knowledge base for engineering/** Knowledge-base of natural science **Problem analysis/** Analysis (uncertainty and incomplete knowledge)
Apply the first law of thermodynamics to closed systems and determine the	**A knowledge base for engineering/** Knowledge-base of natural science

exchange in energy involved with the surroundings.	**Problem analysis/** Problem identification and formulation **Problem analysis/** Problem solving
Apply the first law of thermodynamics to open systems and determine the exchange in energy and mass with the surroundings.	**A knowledge base for engineering/** Knowledge-base of natural science **Problem analysis/** Problem identification and formulation **Problem analysis/** Problem solving
Analyze simple thermodynamic cycles using the 1st law of thermodynamics.	**A knowledge base for engineering/** Knowledge-base of natural science **Problem analysis/** Problem identification and formulation **Problem analysis/** Problem solving
Understand the limitations of the first law of thermodynamics and the need for the second law of thermodynamics.	**A knowledge base for engineering/** Knowledge-base of natural science **Problem analysis/** Analysis (uncertainty and incomplete knowledge)
Apply the concept of Carnot efficiency to thermodynamic cycles.	**A knowledge base for engineering/** Knowledge-base of natural science **Problem analysis/** Problem identification and formulation **Problem analysis/** Problem solving
Utilize the concept of entropy to assess the feasibility of a thermodynamic process.	**A knowledge base for engineering/** Knowledge-base of natural science

Health and Safety Guidelines

All health and safety rules specific to this course can be found in the lab manual. General health and safety instructions and available health and safety trainings can be found at: Safety Programs - Concordia University (https://www.concordia.ca/campus-life/safety/general-safety.html)

On Campus Resources

Please visit Student services at Concordia University for the services available Gina Cody School students.

Territorial Acknowledgement: *I/We would like to begin by acknowledging that Concordia University is located on unceded Indigenous lands. The Kanien'kehá:ka Nation is recognized as the custodians of the lands and waters on which we gather today. Tiohtià:ke/Montréal is historically known as a gathering place for many First Nations. Today, it is home to a diverse population of Indigenous and other peoples. We respect the continued connections with the past, present and future in our ongoing relationships with Indigenous and other peoples within the Montreal community.*