

MECH 351 - Thermodynamics II Winter 2024

Instructor	Office	Email
Dr. Lyes Kadem, ing	EV003.282	lyes.kadem@concordia.ca (Please always use "MECH351" as a subject line)

Section	Date	Time	Location	Office Hours
Lec T	Tuesday-Thursday	13:15 - 14:30	S-FGC080	Office Hours: Tuesdays and Thursdays 5:00 pm -6:00 pm <i>Outside office hours, just bring your smile and/or some chocolate ;-) Note: Do not even think about getting the chocolate from a Dollar store!</i>
Tutorials				Tutorial
Tutorial Instructor				Start Date
Online (visit Concordia Thermodynamics youtube Channel)				January
TA (Maria)				15, 2024
https://www.youtube.com/channel/UCkH6hrwqJ-sBSk78XRWiyIQ/videos				
TA (Xavier)				
https://www.youtube.com/channel/UC-1M9fJv74N5SzzZS3gLqW/featured				

Course Website

The course material will be here: <https://users.encs.concordia.ca/~kadem/teaching/mech351/>

1. Brief course description:

Brief review of ideal gas processes. Semi-perfect gases and the gas tables. Mixtures of gases, gases and vapours, air conditioning processes. Combustion and combustion equilibrium. Applications of thermodynamics to power production and utilization systems: study of basic and advanced cycles for gas compression, internal combustion engines, power from steam, gas turbine cycles, and refrigeration. Real gases. Lectures: three hours per week. Tutorial: one hour per week. Laboratory: two hours per week, alternate weeks.

2. Course Details

2.1 Prerequisite

ENGR 251

2.2 This course is a prerequisite to

MECH 451 (Renewable Energy: Fundamentals and Applications); MECH 452 (Heat Transfer II); MECH 454 (Vehicular Internal Combustion Engines)

2.3 Text Book and additional course materials

Suggested Textbook: There is no textbook. A course pack 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/mech351/>

or on Moodle

The recorded version of the course can be found on [my youtube channel](#).

Instructor’s lecture notes: will be posted in the Moodle course management site and in

<https://users.encs.concordia.ca/~kadem/teaching/mech351/>

Additional References

“Thermodynamics: An Engineering Approach” by Cengel and Boles, any edition with SI units, McGraw Hill.

"Fundamentals of Thermodynamics" by Sonntag, Borgnakke, and Van Wylen, any edition with SI units, Wiley Inc.

“Fundamentals of Engineering Thermodynamics”, Moran, M.J. and Shapiro, H.N., any edition with SI units, Wiley Inc.

Bryan Weber: <https://www.youtube.com/channel/UCBa2h7ktPf1YDpOAAg2rBiA/playlists>

Software Use: DWSIM (<https://dwsim.org/>)

2.4 Knowledge base for engineering prerequisites:

This course requires a very good knowledge in:

- Classical thermodynamics (ENGR251)
- Applying the 1st law of thermodynamics to open and closed systems.
- The knowledge base for engineering required for this course will be tested during Quiz I.

To review ENGR 251 material, visit MIAE 101 On-Line Knowledge-Base Resources for MECH351:

ENGR251 essentials for MECH351: [Video playlist](#) and ENGR251 [course notes](#)

2.5 Course Syllabus

SYLLABUS	
1	Introduction and brief review of Thermodynamics I
2	Vapor and combined power cycles
3	Gas power cycles
4	Refrigeration cycles
5	Thermodynamic property relations
6	Gas-vapor mixtures and air conditioning
7	Chemical reactions and phase equilibrium

2.6 Grading Scheme and Policy

GRADING POLICY		
Evaluation Tool		Weight
Quiz (basic knowledge of ENGR251)	25/01 during lecture time	5.0%
Laboratory		25% (15% for the thermoelectric generator challenge project)
MIDTERM (closed book and notes)	Tentative date: 20/02	30%
Course project (Energy management)	2/04	10%
FINAL (closed book and notes)		30%
Design portfolio (Bonus)	15/04	Up to +3%
Total		103%
Passing Criteria:		
<p># ALL exams are mandatory, and ALL exams will be counted.</p> <p># If you miss the quiz or the midterm, they will be replaced by an oral theoretical examination (not necessarily covering the same topics).</p> <p># Thermoelectric generator challenge project: You will be penalized (-25%, -50% or -100% of the grade) if you are negatively evaluated by your peers.</p> <p>Design portfolio: The objective here is to encourage you to create an online design portfolio where you will be posting your design achievements. This will be a very interesting added value when you will be applying for jobs or internships. In Thermo II, I will be asking you to post the report for the energy project as well as the material regarding your design for the steam car competition. I also encourage you to add your designs for MECH390 and MECH 490, if any. You can use any online free webpage service to create your portfolio (exp: jimdo, weebly, ...). You will be submitting the link to your design portfolio on Moodle to get a bonus up to 3%.</p>		

3. Important dates

January 29, 2024 - last day to drop winter-term courses, without paying fees. (DNE deadline).

April 15, 2024 - last day of classes.

4. Accreditation Unit (AUs)

Course Type	Math	Natural science	Complementary studies	Engineering science	Engineering design	Total AU
Compulsory				75%	25%	100%
				39.0	13.0	52.0

5. Graduate Attribute Curriculum Map - Skills to utilize/learn in the class

Graduate Attributes	Indicators	Level of Knowledge
A knowledge base for engineering	Knowledge base in specific domain	Advanced
Problem analysis	Problem identification and formulation	Advanced
	Modelling	Advanced
	Analysis (uncertainty and incomplete knowledge)	Advanced
Design	Idea generation and selection	Advanced
	Detailed design	Advanced
	Validation and implementation	Advanced
Individual and teamwork	Cooperation and work ethics	Intermediate
	Contribution: practical/conceptual	Intermediate
Impact of engineering on society & the environment	Awareness of society and environment impact	Introductory
Economics and project management	Project planning and implementation	Intermediate
Life-long learning	Continuous improvement and self-learning	Advanced

6. Course Learning Outcomes

By the end of this course students will be able to:

Learning outcome	Attribute / Indicators
Apply the laws of thermodynamics to analyze and improve thermodynamic cycles including vapor and gas power cycles, refrigeration cycles, and heat-pump	A knowledge base for engineering/ Knowledge-base for specific engineering field Problem analysis/ Problem identification and formulation Problem analysis/ Modelling
Develop mathematical formulations for the properties of ideal gas mixtures	A knowledge base for engineering/ Knowledge-base for specific engineering field Problem analysis/ Problem identification and formulation Problem analysis/ Modelling Problem analysis/ Analysis (uncertainty and incomplete knowledge)
Apply the laws of thermodynamics to basic heating, ventilation and air conditioning systems	A knowledge base for engineering/ Knowledge-base for specific engineering field Problem analysis/ Problem identification and formulation Problem analysis/ Modelling
Apply the laws of thermodynamics to basic combustion processes	A knowledge base for engineering/ Knowledge-base for specific engineering field Problem analysis/ Problem identification and formulation Problem analysis/ Modelling Problem analysis/ Analysis (uncertainty and incomplete knowledge)
Design a competitive steam car	Problem analysis/ Problem identification and formulation Problem analysis/ Modelling Problem analysis/ Analysis (uncertainty and incomplete knowledge) Design/ Idea generation and selection Design/ Detailed design Design/ Validation and implementation
Implement an energy solution considering its impact on society and environment	Impact of engineering on society and the environment/ Awareness of society and environment impact Life-long learning/ Continuous improvement and self-learning Economics and project management/ Project planning and implementation

7. 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.

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. Tiohtiá:ke/Montreal 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.

Reconnaissance territoriale

J'aimerais / Nous aimerions commencer par reconnaître que l'Université Concordia est située en territoire autochtone, lequel n'a jamais été cédé. Je reconnais/Nous reconnaissons la nation Kanien'kehá: ka comme gardienne des terres et des eaux sur lesquelles nous nous réunissons aujourd'hui. Tiohtiá:ke / Montréal est historiquement connu comme un lieu de rassemblement pour de nombreuses Premières Nations, et aujourd'hui, une population autochtone diversifiée, ainsi que d'autres peuples, y résident. C'est dans le respect des liens avec le passé, le présent et l'avenir que nous reconnaissons les relations continues entre les Peuples Autochtones et autres personnes de la communauté montréalaise.

8. On Campus resources

<p>HEALTH SERVICES An on-campus health clinic and health promotion center with nurses and doctors. SGW 514-848-2424 ext. 3565 LOY 514-848-2424 ext. 3575</p>	<p>COUNSELLING AND PSYCHOLOGICAL SERVICES Counsellors (licensed mental health professionals) work with students to address their mental health and wellbeing needs. SGW 514-848-2424 ext. 3545 LOY 514-848-2424 ext. 3555</p>
<p>ACCESS CENTRE FOR STUDENTS WITH DISABILITIES Supports students with a variety of disability conditions (including temporary disabilities arising from illness or injury). Students receive academic support for their educational experience at Concordia. acsinfo@concordia.ca 514-848-2424 ext. 3525</p>	<p>SEXUAL ASSAULT RESOURCE CENTRE Provides confidential and non-judgemental support and services to students, staff and faculty of all genders and orientations affected by sexual violence and/or harassment. Jennifer Drummond, Coordinator jennifer.drummond@concordia.ca sarc@concordia.ca 514-848-2424 ext. 3353</p>
<p>STUDENT SUCCESS CENTRE Support network from first-year to graduation. You'll find one-on-one tutors, study groups, workshops as well as learning and career advisors. 514-848-2424 ext. 3921</p>	<p>DEAN OF STUDENTS Supports students to enhance their Concordia experience by engaging in student life outside the classroom. Terry Kyle, Manager deanofstudents.office@concordia.ca SGW 514-848-2424 ext. 3517 LOY 514-848-2424 ext. 4239</p>
<p>ABORIGINAL STUDENT RESOURCE CENTRE An on-campus resource for First Nations, Métis and Inuit students that helps them make the most of the many resources available at the university. Orenda Konwawennotion Boucher-Curotte, Coordinator orenda.boucher@concordia.ca 514-848-2424 ext. 7327</p>	<p>INTERNATIONAL STUDENTS OFFICE Supporting international students with immigration documents, health insurance, social events, and workshops. iso@concordia.ca 514-848-2424 ext. 3515</p>
<p>STUDENT ADVOCACY OFFICE Advocating for students facing charges under the Academic Code of Conduct or the Code of Rights and Responsibilities. studentadvocates@concordia.ca 514-848-2424 ext. 3992</p>	<p>MULTI-FAITH & SPIRITUALITY CENTRE Provides a home for all those wishing to celebrate the human spirit in the widest sense of the word, through programs, events and a quiet space for reflection. Ellie Hummel, Coordinator mfsc@concordia.ca 514-848-2424 ext. 3593</p>
<p>CAMPUS SECURITY Ensures the safety of our members and campus property through prevention, surveillance, intervention, training, and education. Provides emergency medical services.</p>	<p>CONCORDIA UNIVERSITY STUDENT PARENTS CENTRE An accessible space for student parents to study, share interests and develop a support network.</p>

9. 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.