Western University
Department of Mechanical & Materials Engineering

MME 3334B – Thermodynamics II

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION: This course emphasizes the application of thermodynamic principles to engineering systems and problem solving. Topics covered include: sonic velocity and compressible flow through nozzles, reciprocating and rotary compressors, availability and irreversibility in systems and processes, cycles, psychrometry of air conditioning, thermodynamic relations and the generalized compressibility charts, chemical reactions and equilibrium.

COURSE INFORMATION:

Instructor: Professor C. Zhang

Email: czhang@eng.uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

CONSULTATION HOURS: By appointment.

PREREQUISITES: MME 2204a/b

ANTIREQUISITES: None.

ACCREDITATION UNITS: Engineering Science = 100%

TOPICS:

1. Review of first and second laws of thermodynamics
2. Second-law analysis of engineering systems and exergy
3. Power cycles
4. Refrigeration cycles
5. One-dimensional compressible flow
6. Mixtures, psychrometrics and introduction to air conditioning

LEARNING OUTCOMES: The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and Western Engineering's GA Indicators are identified below.

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

1. Determine exergy, irreversibility and second law efficiency (KB2, KB3, PA1, PA2)
2. Conduct second-law analysis of closed systems (KB3, PA1, PA2)
3. Conduct second-law analysis of steady-flow systems and unsteady-flow systems (KB3, PA1, PA2)
4. Conduct thermodynamic analysis of gas and vapor power cycles and

modify the cycles to increase thermal efficiency, thereby reducing CO_2 emissions and minimizing environmental impact (KB3, KB4, PA1, PA2, IESE3)
5. Conduct second-law analysis for gas and vapor power cycles (KB3, KB4, PA1, PA2)
6. Conduct thermodynamic analysis for vapor-compression refrigeration cycles, heat pump systems and gas refrigeration cycles (KB3, KB4, PA1, PA2)
7. Perform analysis for isentropic flows with simple area change with or without a normal shock wave (KB3, KB4, PA1, PA2)
8. Determine composition of a gas mixture (KB2, KB3, PA1, PA2)
9. Predict the P-v-T behavior of gas mixture (KB2, KB3, PA1, PA2)
10. Determine properties of gas mixtures (KB2, KB3, PA1, PA2)
11. Calculate the specific and relative humidity of air, and dew-point temperature (KB2, KB3, PA1, PA2)
12. Conduct analysis for adiabatic saturation processes (KB3, KB4, PA1, PA2)
13. Use a psychrometric chart (KB3, KB4, PA1, PA2)
14. Perform analysis for basic air conditioning processes (KB3, KB4, PA1, PA2)
15. Report experimental observations (I2, I3)
16. Interpret experimental outcomes in terms of the relevant theory (I2, I3)

CONTACT HOURS: 3 lecture hours, 2 tutorial hours, 0.17 laboratory hours/week (2 lab activities, 1 hour each), half course

TEXTBOOK: Yunus A. Cengel and Michael A. Boles, "Thermodynamics, An Engineering Approach", 10th Edition, McGraw-Hill.

The textbook is required, and the cost of the textbook is listed as $122.35 from the UWO Bookstore.

https://bookstore.uwo.ca/

Students are welcome to purchase second-hand or earlier editions (6th - 9th editions) of this textbook.

UNITS: SI.

EVALUATION: The course grade will be determined approximately as follows:

Quiz #1	6%
Quiz #2	4%
Laboratories:	10% (5% for each lab)
Mid-term Test:	25%
Final Examination:	55%

Quizzes - 3:30-4:30 p.m. on Monday, Feb. 2 and Mar. 23, 2026
Mid-term test - 2:30 - 4:30 p.m. on Monday, Mar. 2, 2026

COMPUTING: Some problems may require computing.

ASSIGNMENTS: Each week starting from the 2nd week till the 12th week there will be an assignment (4-6 problems), which will normally be assigned at the Monday class. These problems will indicate the level of student achievement expected. The students are not required to hand in the assigned problems for grading.

TUTORIALS: During the tutorial periods, the teaching assistants will be available to help students with solving the assignment problems, to answer questions and to provide additional explanation of the lecture material if needed. There will be 2 quizzes held during the tutorial period. The questions in the quizzes will be from the assignments.

LABORATORIES: Each student will conduct two experiments (1) **The Performance of a Small-scale Refrigeration Unit** and (2) **Air Compressor**. The experiments will be conducted in groups of 3 – 4 students (detailed schedule to be determined). Lab reports will be submitted as group reports and are due **one week** after the laboratory experiment is conducted.

EXAMINATIONS AND QUIZZES: Quizzes – **Closed book**. Two summary pages (8.5"x11", both sides) and non-programmable calculator are allowed. Property tables will be provided.
Term test and final examination are **Limited Open Book –** textbooks, calculators and two summary pages (8.5"x11", both sides) will be allowed. You can use your laptop/iPad to access the textbook by the mouse or touchpad only. Property tables will be provided.

COURSE POLICIES: The following **course-specific** policies will be strictly enforced throughout the course:

Due to the nature and structure of the evaluation in this course, it is exempt from the 15% policy. This means that you will not have received 15% of your grade prior to the course drop deadline.

Laboratory sessions

• Laboratory attendance is compulsory.

• Passing the laboratory component of the course (i.e., at least 50% mark in the laboratory component) is necessary to pass the course

• Students who arrive 30 min after the scheduled lab time or miss the lab without academic consideration will be given one time only chance to conduct the lab (at a rescheduled time) with 50% penalty.

• Students who miss a lab with academic consideration are required to reschedule the lab by contacting the course instructor. Failure to do so will result in a zero mark for that lab

• Missing both labs without academic consideration will result in the course failure

Quizzes

• No make-up quiz options will be offered regardless of the circumstances for which the quiz was missed

• Missing quizzes with academic consideration will shift the weight of the missed quizzes into the final exam

• Missing of a quiz without academic consideration will translate into a zero mark for that quiz

Midterm exam (designated assessment)

• No make-up midterm options will be offered regardless of the circumstances for which the midterm was missed

• Missing the midterm with academic consideration will shift the weight of the missed midterm exam into the final exam

• Missing the midterm exam without academic consideration will translate into a zero mark for the midterm

Final exam

• If a minimum of 50% is not obtained on the final examination, the student will be assigned a grade of no greater than 48% for the course.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.