Western University
Department of Mechanical & Materials Engineering

MME 2204a – Thermodynamics I

COURSE OUTLINE - 2026-2027

CALENDAR DESCRIPTION: Properties of a pure substance, first law of thermodynamics, processes in open and closed systems, second law of thermodynamics; ideal gases, compressors and energy conversion systems.

COURSE INFORMATION:

Instructor: Prof. A. G. Straatman, Ph.D., P.Eng., FCSME, FCAE
Room SEB 3002A
Email: agstraat@uwo.ca
Telephone: 519-661-2111, ext. 88249

Lectures: See Draft My Schedule

Tutorial: See Draft My Schedule

Labs: 2 lab exercises will be conducted during the term. These will be scheduled during your allocated lab times on specific dates to be determined.

PREREQUISITES: NMM 1412A, NMM 1414B

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

ANTIREQUISITES: CBE 2214a/b; MSE 2214a/b

ACCREDITATION UNITS: Science = 40%, Engineering Science = 60%

TOPICS:

- Introduction and definitions
- Properties of a pure substance
- Work and heat; first law and the closed system
- First law and the open system
- First law application
- Second law of thermodynamics
- Power Cycles and Refrigeration Cycles
- Entropy changes of closed, open, reversible, and irreversible systems
- 1st and 2nd law relationships and the universal principal of entropy increase
- Second law application

Introductory lectures will be selected from the following topics:
Reciprocating machines; Steam power cycles; Refrigeration cycles.

LEARNING OUTCOMES:

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

1. Apply fundamental theories of classical thermodynamics including equilibrium, irreversibility and state postulate; (PA1, PA2)
2. Characterize the thermodynamic state of a pure substance in any phase or combination of phases; (KB2, KB3, KB4, IN2, IN3)
3. Classify a thermodynamic system as isolated, open or closed, identify transfers of energy via work and heat, and apply the first and second laws of thermodynamics; (KB2, PA1, PA2)
4. Characterize thermal efficiency and isentropic efficiency of systems and devices in terms of the laws of thermodynamics and corollaries of these laws. (KB4, PA3)

The terms in parentheses following each learning outcome refer to Graduate Attributes (GAs) established by the Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. These attributes are used in the accreditation process to ensure that accredited engineering programs are providing the academic requirements for licensure as a professional engineer in Canada. Information on Graduate Attributes and Indicators can be found at GA Indicators. The table below indicates which specific attributes are measured in this course and the level at which it is measured, wherein I=*Introduced*, D=*Developed* and A=*Advanced/Applied*

CEAB Graduate Attribute Learning Levels for this course:

Knowledge Base	I	Engineering Tools		Impact on Society	
Problem Analysis	I	Individual & Teamwork		Ethics and Equity	
Investigation	I	Communication		Economics & Project Mgmt.	
Design		Professionalism		Life-Long Learning	

CONTACT HOURS: 3 lecture hours, 2 tutorial hours per week, two labs activities lasting 3 hours each, half course.

TEXTBOOK: "Thermodynamics, An Engineering Approach", 10th Edition. Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu; McGraw-Hill. (*Western Bookstore*)

Students are welcome to purchase second-hand or earlier editions of this textbook. Editions 8, 9 are acceptable; all assigned problems are based on edition 10.

REFERENCES: "Fundamentals of Engineering Thermodynamics," 6th Edition, Copyright 2008; Michael J. Moran & Howard N. Shapiro, John Wiley & Sons Inc. ISBN 978 0470 106747

UNITS: SI will be used, however English units may be introduced as required.

EXAMINATIONS AND QUIZZES: The term tests and final examination are **closed book type**. Only non-programmable pocket calculators are allowed.

EVALUATION:

The final grade is computed as follows:

Evaluation Format	Weight	Effort Type	Due	CEAB GAs ASSESSED
Weekly collaborative tutorial exercises (best 6 or 8)	10%	Team	Weekly, during tutorial	
Laboratory exercises	10%	Team	Schedule to be announced	I2, I3
Midterm Tests	15%, 15%	Individual	2:30-4:20 Oct. 7 2:30-4:20 Nov. 11	KB4
Final Exam	50%	Individual	Dec. Exam Period	PA2

In addition, problems will be assigned from the textbook on a weekly basis. These problems will not be handed in or graded but will be discussed each week during the tutorial sessions.

If a minimum mark of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

COURSE POLICIES:

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

1. Tutorial Exercises will be conducted weekly in the second half of the tutorial session. The Exercises will be done in groups of up to four students and the 10% grade will be calculated based on your best 6 of 8 Exercises. Since this flexibility in terms of grading is being provided, any requests for academic consideration will be denied.
2. There are no makeup tests for missed Term Tests. Students who miss a Term Test with academic consideration will have its weighting transferred to the Final Exam.
3. Term Test 1 (Scheduled for Oct 7, 2026) is a designated assessment.

NOTE:

Students who have failed an Engineering course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

The above topics and outline are subject to adjustments and changes as needed.

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 policies 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.

The policy covers:

- Absence/Late Accommodation Policy
- Religious Accommodation
- Academic Integrity
- Academic Offences
- Faculty of Engineering AI Policy
- Accessibility
- Inclusivity, Diversity, and Respect
- Health and Well-being
- Gender-Based and Sexual Violence