

Western University
Department of Mechanical & Materials Engineering

MME 4423A – Internal Combustion Engines

COURSE OUTLINE – 2026-2027

**CALENDAR
DESCRIPTION:**

This course elaborates on the fundamentals of internal combustion engines and what affects their performance, operation, fuel requirements, and environmental impact. The course considers thermodynamic, combustion, heat transfer and friction phenomena, and fuel properties, relevant to engine power, efficiency and emissions, and examines design features and operating characteristics of different types of internal combustion engines; including spark-ignition, diesel, stratified-charge, mixed-cycle engines.

**COURSE
INFORMATION:**

Instructor: Dr. Rex Sherratt

Email: asherra@uwo.ca

Lectures/tutorials/labs: See [Draft My Schedule](#)

**CONSULTATION
HOURS:**

By appointment

PREREQUISITES:

MME 3334A/B

ANTIREQUISITES:

None

**ACCREDITATION
UNITS:**

Engineering Science = 75%, Complementary Studies = 25%

TOPICS:

1. Introduction to internal combustion engines
2. Overall engine performance; engine testing
3. Advanced gas cycles; the Miller cycle
4. Fuel air and combustion thermodynamics
5. Fuel air cycles; finite heat release
6. Heat and mass transfer
7. Combustion thermodynamics and heat release
8. Fuels and lubricants
9. Emissions
10. Future engine technology

**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. describe the basic operation of different IC engines including the method of combustion, engine speed control and all the major components; (KB4)
2. conduct performance analysis of IC engines based on engineering parameters such as mean-effective pressure and volumetric efficiency; (I1)
3. conduct complete thermodynamic analyses of IC engines including the effects of residual mass fraction, finite heat release, valve timing, and heat losses; (ET2)
4. carry out calculations of combustion reactions for hydrocarbon fuels using simple stoichiometric analysis, and general chemical equilibrium modeling; (ET2)
5. characterize properties of fuels in terms of octane number, cetane number and volatility; (KB4)
6. quantify the impact of air/fuel equivalency ratio, mixing and combustion temperature on emissions; emission control; (IESE2, IESE3)
7. characterize engine enhancements in terms of their impact on combustion efficiency, overall engine performance and emissions; (I3)
8. conduct laboratory tests on IC engines (I2)

COMPUTING

Computing is required in this course. Students will be required to use Microsoft EXCEL and MATLAB to carry out assignments and analyses.

CONTACT HOURS:

3 lecture hours, 0.25 laboratory hours per week (3 one-hour laboratory exercises per term); half course

TEXTBOOK:

None required.

Reference:

Ferguson C.R, Kirkpatrick, A.T., Internal Combustion Engines, Applied Thermosciences, 3rd-Edition, Wiley, 2016. (not required to purchase)

UNITS:

SI will be used; however, English units may be introduced through examples as required.

ASSIGNMENTS

Five formal problem sets will be assigned in (approximately) weeks 3, 6, 8, 10 and 12, respectively, depending on the pace of the course, and each shall be graded and weighted towards 20% of the final course grade. The student should learn to solve these problems in a good professional style. These problems will be assessed and handed back to the students in a timely manner.

If deadlines for assignments are not met, a two-day grace period will be allowed

without penalty. A delay of more than two days will result in a mark of zero. Please note that because the submission deadline for these assignments already includes flexibility in the form of a 48-hour submission window, the instructor reserves the right to deny academic consideration for assignments which are submitted following the end of the period of flexibility.

EVALUATION:	Assignments	20%
	Laboratories	20%
	Project	15%
	Final exam	45%

Important Note:

Any assignment missed with academic consideration will have its weight added to the final examination. Students must complete all laboratory exercises (including the report) to pass 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 policies can be found here:

<https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/UG-Policy-Framework-Missed-Classes-Late-Work-and-Academic-Integrity1.pdf>

Important Links

- [WESTERN ACADEMIC CALENDAR](#)
- [ACADEMIC RIGHTS AND RESPONSIBILITIES](#)
- [ENGINEERING PROGRESSION REQUIREMENTS AND ACADEMIC REGULATIONS](#)
- [UNIVERSITY STUDENTS' COUNCIL \(USC\) - SERVICES](#)
- [IMPORTANT DATES AND DEADLINES](#)
- [ACADEMIC CONSIDERATION FOR MEDICAL ILLNESS - UNDERGRADUATE STUDENTS](#)
- [ACCOMMODATIONS FOR RELIGIOUS HOLIDAYS](#)
- [SCHEDULING OF ASSIGNMENTS, TESTS, AND EXAMINATIONS](#)
- [STUDENT FORMS](#)
- [OFFICE OF THE REGISTRAR](#)
- [RETENTION OF ELECTRONIC VERSION OF COURSE OUTLINES \(SYLLABI\)](#)
- [ACADEMIC APPEALS](#)
- [STUDENT ABSENCE PORTAL](#)

Note: These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

Add / Drop Deadlines:

- September 15, 2026 → Last day to add/drop a Fall 6-week first quarter (Q) course

- January 8, 2027 → Last day to add/drop a Winter 6-week first quarter (S) course
- January 15, 2027 → Deadline to declare a Discovery Credit for a Fall 12-week course.

Contact Information:

Undergraduate Services Office:	SEB 2097
Phone: 519-661-2130	E-mail: engugrad@uwo.ca
Mechanical Engineering:	SEB 3002
Phone: 519-661-4122	E-mail: mmeundergraduate@uwo.ca
Chemical & Green Process Engineering:	TEB 477
Phone: 519-661-2131	E-mail: cbeugrad@uwo.ca
Civil Engineering:	SEB 3005
Phone: 519-661-2139	E-mail: civil@uwo.ca
Computer, Electrical, Mechatronic Systems & Software Engineering	TEB 279
Phone: 519-661-3758	E-mail: eceugrad@uwo.ca
Integrated Engineering	ACEB 2410
Phone: 519-661-6725	E-mail: engceli@uwo.ca
Office of the Registrar/Student Central	WSSB 1120
Phone: 519-661-2100	