



**DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
SOFTWARE ENGINEERING**

SE 3310A – Theoretical Foundations of Software Engineering
Course Outline Fall 2026

COURSE DESCRIPTION:

An introduction to the theoretical foundations of Software Engineering, including formal languages, automata theory, computability, and computational complexity. This course examines fundamental questions of software engineering, including: What is computation? How hard (or easy) is it to compute various types of problems? What are the fundamental limits to what can and cannot be computed?

ACADEMIC CALENDAR: SE 3310 A/B

https://www.westerncalendar.uwo.ca/Courses.cfm?CourseAcadCalendarID=MAIN_017644_1

PRE OR COREQUISITES: Registration in the third year of the Software Engineering program

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may 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.

CEAB ACADEMIC UNITS: Engineering Science 100%

INSTRUCTOR INFORMATION:

Name:

Title:

Office Hours:

Email:

TA:

CONTACT HOURS:

Timetable information is available at <https://draftmyschedule.uwo.ca/>.

LECTURE:	
TUTORIAL:	

REQUIRED TEXT:

Michael Sipser. *Introduction to the Theory of Computation*, 3rd Edition, Cengage Learning, 2012. Approximate cost: CAD \$71.99. <https://faculty.cengage.com/works/9781133187790>

Anil Maheshwari and Michiel Smid. *Introduction to Theory of Computation*, 2012. Available at cg.scs.carleton.ca.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

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

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e.g. no review).

COURSE MATERIALS:

Weekly lecture notes, the course schedule, announcements and all important dates will be available on the OWL Brightspace course site: <https://westernu.brightspace.com>

The material for this course will be taught in both lectures and tutorials; therefore, it is imperative that you attend each lecture and tutorial.

UNITS: SI

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES:

This is a standard course in the theory of computation with some emphasis on applying the theory to practical software engineering situations, such as reasoning about broad technology trends like quantum computing and AI. Students will develop knowledge and skills that allow them to take an integrated approach to reasoning about the fundamental limits of software engineering.

The following table summarizes the course learning outcomes along with CEAB GAs where the GAs in bold indicate ones to be measured and reported annually.

	CEAB GA Indicators
1. Regular Languages	
a. Construct deterministic finite automata and non-deterministic finite automata to recognize various regular languages	KB4, PA1
b. Construct regular expressions to generate various regular languages	KB4, PA1
c. Prove a language is not regular (Pumping Lemma)	I1, I3
2. Context-free Languages	
a. Construct pushdown automata to recognize various context-free languages	KB4
b. Construct context-free grammars to generate various context-free languages	KB4
3. Recursively Enumerable Languages	
a. Construct deterministic and non-deterministic Turing machines to recognize various recursively enumerable languages	PA1
4. Undecidability and Computability	
a. Understand the notion of Turing completeness and the difference between Turing recognizable and Turing decidable languages	KB4
b. Prove a language is undecidable (Turing's correspondence)	I1, I2, I3

5. Complexity Theory	
a. Understand the notions of worst-case running time and construct polynomial-time reductions between algorithms	PA1
b. Understand the theoretic and practical relationships between several important computational complexity classes: P, NP, NP-Complete, NP-Hard, BQP, and BPP	KB4
c. Prove a given problem is in a given complexity class	I1, I2, I3
d. Understand the significance of the greatest open problem in computing: Does $P=NP$?	KB4
e. Be able to state important theoretic and real-world problems in each of these classes	KB4
f. Gain a basic insight into the difference between classical and quantum computers	KB4

EVALUATION:

Name	% Worth	Assigned	Due Date	CEAB GAs ASSESSED
Assignment 1	5%			I1-1
Assignment 2	5%			I3-1
Assignment 3	5%			
Assignment 4	5%			
Assignment 5	5%			
Midterm Test	25%			KB4-1, PA1-1
Final Exam	50%			I2-1

Note that the dates listed above are tentative and may be adjusted if needed. Assignments are due at **11:55pm** on the due date.

COURSE POLICIES:

All work submitted must be of professional quality in the requested format. Material that is handed in dirty, illegible, disorganized, or in an unapproved format will be returned to the student for resubmission, and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence, or lack of flow in the written reports.

ASSIGNMENTS:

There will be 5 assignments worth **5% each**, which will be submitted online in Gradescope. Assignments are due at **11:55pm** on the due date (listed above) but are subject to a flexible deadline (see Late Submission Policy below). **Email submissions will not be accepted.**

Assignment formatting requirements. You must use a software tool for any diagrams involving automata. Hand-drawn automata diagrams will not be accepted. Two options are recommended:

- LaTeX with TikZ. If you do not want to install LaTeX locally, [Overleaf](#) provides a cloud-based interface. A tutorial on drawing automata is available at [latexdraw.com](#).
- The online Graphviz visual editor at [magjac.com/graphviz-visual-editor](#). A worked example will be provided on OWL Brightspace.

LECTURES:

Attendance in the lecture sessions is mandatory; however, attendance is not formally tracked. Students who miss a lecture should consult the course lectures posted online.

TUTORIALS:

Tutorials run every week. The tutorial sessions will be used to (1) discuss assignments and solution strategies, (2) take up solutions to completed assignments, (3) answer questions about the course material, and (4) hold the mid-term test. Electronic solutions to the assignments and midterm will not be provided; therefore, attendance in the tutorial sessions is essential for success in the course. Attendance in the tutorial sessions is mandatory; however, attendance is not formally tracked. Students who miss a tutorial session are expected to arrange with another classmate to obtain the tutorial notes.

MIDTERM TEST:

A **one-hour** midterm test will take place during one of the weekly tutorial sessions. The test will cover **up to and including context-free grammars**. The specific examination room will be announced at a later date. The midterm is **in-person and closed-book**. **No notes, calculators or electronic devices are permitted.** The content of the test will be structured considering these factors. The test will consist of a mixed combination of multiple-choice and short-answer questions. The midterm is a **designated assessment**, meaning formal supporting documentation will be required for any student missing the midterm. **A missed midterm will not be rescheduled. Instead, the mark value will be re-weighted into the final exam.** For more information, consult Western's policies on academic consideration:

https://registrar.uwo.ca/academics/academic_considerations/

If a student is going to miss the midterm test for religious reasons, they must inform the instructor in writing **within 48 hours of the announcement of the test date**, or they will be required to write the test at the scheduled time.

FINAL EXAMINATION:

A **two-hour** final exam will take place during the regular examination period (**December 11 to 22, 2026**). The final exam is **in-person and closed-book**. **No notes, calculators or electronic devices are permitted.** The content of the exam will be structured considering these factors. The exam will consist of a mixed combination of multiple-choice and short-answer questions. The course grade will be calculated based on performance in each of the course components listed above. **The course does not require a passing grade on the final exam to pass the course.**

LATE SUBMISSION POLICY:

This course employs **flexible deadlines** for assignments. The assignment deadlines can be found in the course outline above. For each assignment, students are expected to submit the assignment by the deadline listed. Should illness or extenuating circumstances arise, students are permitted to submit their assignment up to **48 hours (2 days) past the deadline without academic penalty.**

The end of the 48-hour flexible submission grace period will coincide with a tutorial session, during which the assignment solutions will be discussed. In fairness to other students, **the assignment submission website will not accept assignments after the tutorial session begins.** Unsubmitted assignments will receive a mark of **zero (0)**. There are no make-up assignments or other extra-credit opportunities for unsubmitted assignments.

As flexible deadlines are used in this course, **requests for academic consideration will not be granted**. If you have a long-term academic consideration or an accommodation for disability that allows greater flexibility than provided here, please reach out to your instructor **at least one week before the posted deadline**.

It is your responsibility (a) to know the assignment due dates, (b) to understand the course late submission policy, and (c) to manage your time appropriately, including building resilience in your schedule against unforeseen delays.

ATTENDANCE:

Attendance is mandatory for all lectures and tutorials; however, attendance is not formally tracked. Please refer to the course policies above.

USE OF ELECTRONIC DEVICES:

Electronic devices are permitted during lectures and tutorials so far as, in the discretion of the instructor, they do not distract or disrupt the learning of others. **No electronic devices of any kind are permitted during the midterm test or the final examination.**

USE OF GENERATIVE ARTIFICIAL INTELLIGENCE IN THIS COURSE:

Generative AI tools are **permitted for the assignments** in this course, provided that their use is disclosed and referenced as required by the Faculty of Engineering AI Policy reproduced below. **Generative AI tools are not permitted in the midterm test or the final examination.** Detected use in those assessments may result in academic offence penalties.

SIMILARITY REVIEW OF COMPUTER-MARKED ASSESSMENTS:

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

FACULTY OF ENGINEERING POLICIES

The sections below are reproduced from the Faculty of Engineering *Policy Framework: Missed Classes, Late Work, AI Policy and Academic Integrity*. The complete framework, including the Senate rules on Scheduling Assignments and Tests, is available at [eng.uwo.ca – Undergraduate Policies](https://eng.uwo.ca/UndergraduatePolicies). Students are responsible for familiarising themselves with it.

I. Absence / Late Accommodation Policy

1. Students must familiarise themselves with the University Policy on Academic Consideration – Undergraduate Students in First Entry Programs, posted on the Academic Calendar: [academic consideration Sep24.pdf](#). This policy does not apply to requests for Academic Consideration submitted for attempted or completed work, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.
2. Students missing a test, assignment, lab or examination will report the absence by submitting an Academic Consideration Request form through the STUDENT ABSENCE PORTAL.
3. All requests for Academic Consideration must be made **within 48 hours after the assessment date or submission deadline**. All Academic Consideration requests must include supporting documentation. However, recognising that formal documentation may not be available in some extenuating circumstances, the policy allows students to make **one** Academic Consideration request without supporting documentation in this course. The following assessments are excluded from this, and therefore always require formal supporting documentation:
 - Examinations scheduled during official examination periods.
 - Any designated assessments as noted on the course outline.

Furthermore, students should not request Academic Consideration for any assessment which offers a flexible deadline or flexibility in grading. **Requests for Academic Consideration (for any reason) for assessments with built-in flexibility may be denied.** If a student mistakenly submits their one allowable undocumented Academic Consideration request for an assessment listed above, the request cannot be recalled and reappplied. This privilege is forfeited.

4. Requests without supporting documentation are limited to one per term per course.
5. An undocumented absence is only valid for a **24-hour period**, from midnight on the day specified to midnight of the following day. Where the time given to complete an assessment is longer than 24 hours, an undocumented absence will not cover a student for the full time given, and flexibility considerations in submitting the assessment will override the undocumented absence.
6. Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence.
7. It is the student's responsibility to check the date, time and location of a Special Examination.

II. Religious Accommodation

When scheduling unavoidably conflicts with religious holidays, which (a) require an absence from the University or (b) prohibit or require certain activities (i.e., activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), no student will be penalized for absence because of religious reasons, and alternative means will be sought for satisfying the academic requirements involved. If a suitable arrangement cannot be worked out between the student and instructor involved, they should consult the appropriate Department Chair and, if necessary, the student's Dean.

It is the responsibility of such students to inform themselves concerning the work done in classes from which they are absent and to take appropriate action.

III. Academic Integrity

In the Faculty of Engineering, we encourage students to create a culture of honesty, trust, fairness, respect, responsibility, and courage, befitting the professional degree you are pursuing.

Please visit [Academic Integrity Western Engineering](#) for more information.

IV. Academic Offences

Plagiarism means using another's work without giving credit. The university has rules against plagiarism and other scholastic offences. Western Engineering has a **zero-tolerance policy on plagiarism. The minimum penalty is zero on the course work, a repeat offence will earn you zero on the course, and a third offence may lead to expulsion from the university.**

Students must write their reports, essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>). Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook: [scholastic discipline undergrad.pdf](#)

V. Faculty of Engineering AI Policy

The use of generative Artificial Intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. You are able to use GenAI tools as follows:

- For any written assignment, except take-home exams and personal reflections, you may use a GenAI tool to help you brainstorm or frame your initial ideas and grammar. However, your final submission must be entirely in your own words and demonstrate your individual experience and insight.
- For any written or practical project, AI tools may be used across your workflow. Use them responsibly and reflect in your final presentation on how these tools supported or challenged your creative thinking.
- All GenAI tools used at any point of the course with the intent of helping with homework, assignments or any other assessment content must be disclosed and referenced appropriately.

GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

In this course, GenAI tools are not permitted in the midterm test or the final examination.

VI. Accessibility

Western is committed to achieving barrier free accessibility for persons with disabilities studying, visiting and working at Western. As part of this commitment, there are a variety of services, groups and committees on campus devoted to promoting accessibility and to ensuring that individuals have equitable access to services and facilities. To help provide the best experience to all members of the campus community, please visit [Accessibility Western University](#) for information on accessibility-related resources available at Western.

Students with disabilities may arrange for academic accommodation at Western. For a more detailed explanation, please visit [Academic Support & Engagement – Academic Accommodation](#).

VII. Inclusivity, Diversity, and Respect

The Faculty of Engineering at Western University is committed to creating equitable and inclusive learning environments that value diverse perspectives and experiences. We recognize that university courses often marginalize students based on social identity characteristics such as, but not limited to, Indigeneity, race, ethnicity, nationality, ability, gender identity, gender expression, sexuality, age, language, religion, and socioeconomic status. Understanding this, we strive to facilitate equitable experiences and inclusion within the classroom by respecting and integrating multiple ways of knowing, being, and doing. Please visit the [Office of Equity, Diversity and Inclusion](#).

VIII. Health and Well-Being

- **Health & Wellness Services – Students.** Offers appointment-based medical clinic for all registered part-time and full-time students.
- **Mental Health Support.** Provides professional and confidential services, free of charge, to students needing assistance to meet their personal, social and academic goals. Services include consultation, referral, groups and workshops, as well as brief, change-oriented psychotherapy.
- **Crisis Support.** For immediate assistance, please visit Thames Hall Room 2170 or call 519-661-3030. The crisis clinic operates between 11:00 am and 4:30 pm. After-hours crisis support is also available.
- **Discrimination, Harassment and Sexual Misconduct.** This policy is in accordance with all applicable federal and provincial legislation related to Discrimination, Harassment and Sexual Misconduct, such as the Ontario Human Rights Code. It also applies to those situations defined as Workplace Harassment under the Occupational Health and Safety Act.

IX. Gender-Based Violence and Survivor Support

Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts on the [Wellness and Wellbeing website](#). To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Important Contacts

Engineering Undergraduate Services		
Electrical and Computer Engineering		
Office of the Registrar / Student Central		

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](#)

USE OF ENGLISH

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work except for the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.